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Telephony.

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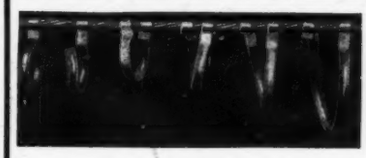

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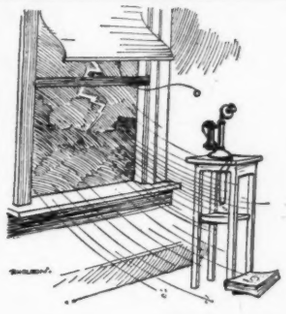

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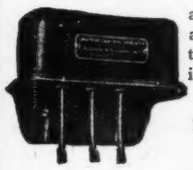

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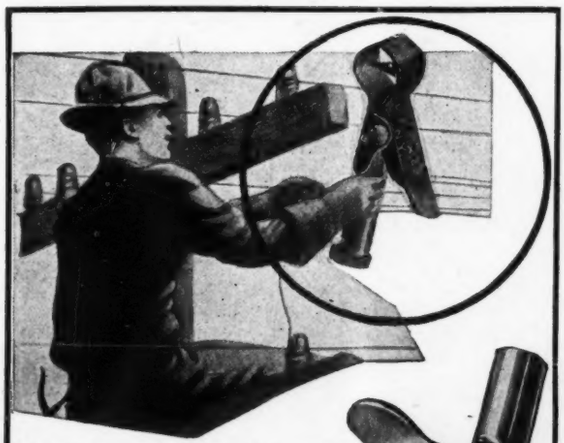

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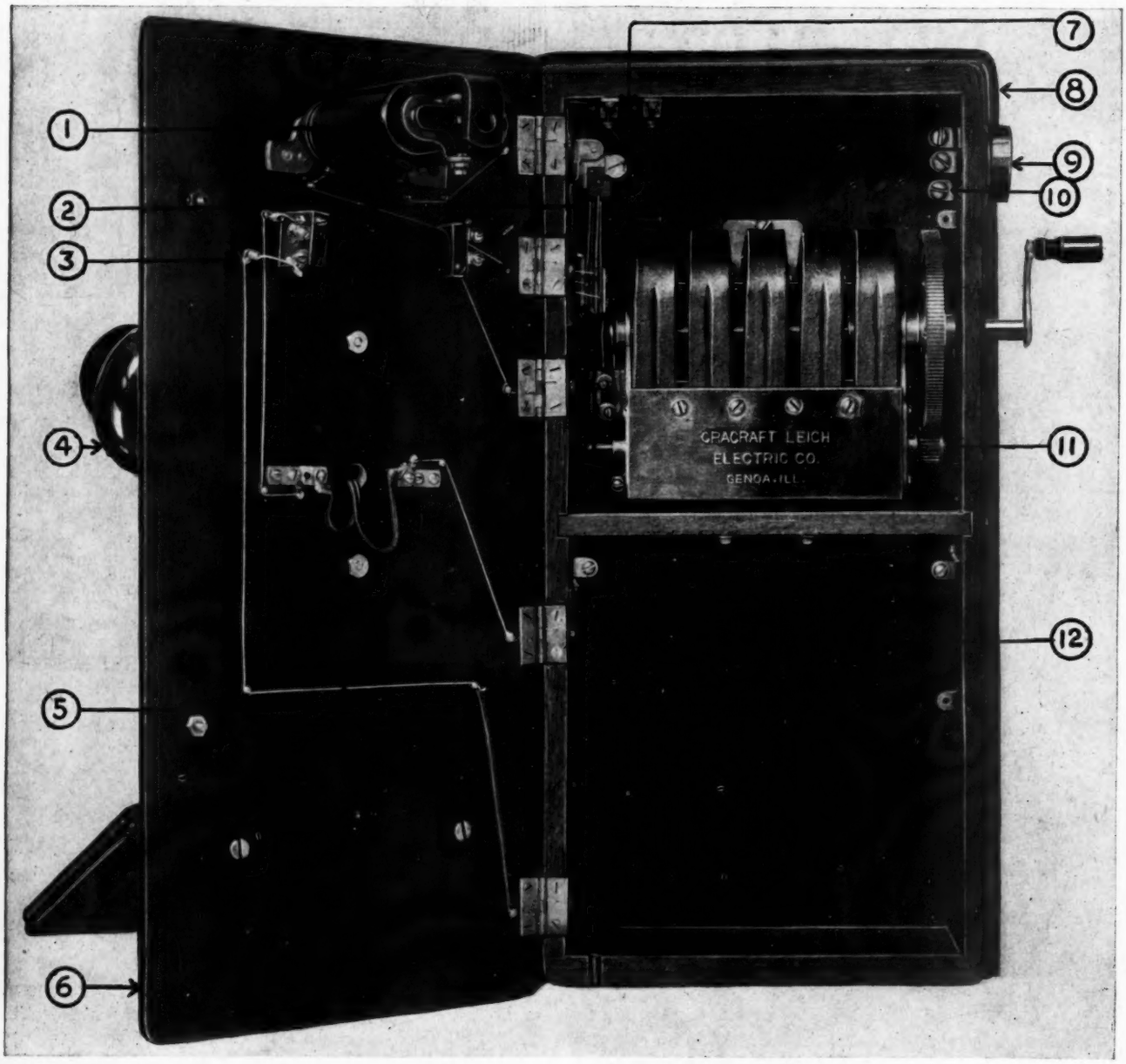

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Telephony.

THE AMERICAN TELEPHONE JOURNAL

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Bill the Troubleman says:

"In all the years I have been shooting trouble—and they have been many—I have never known the outlook in the telephone field to be brighter than at the present time. That "divine right" stuff constantly pulled by the Bell crowd is getting to be a chestnut, and a few more moves like the Kingsbury commitment and the Western Electric withdrawal bluff, will force the government to take over the Bell telephone system. All the telephone business needs is a common sense policy, but, believe me, that will never emanate from 15 Dey Street."

Keep Up the Fight.

Information which comes to TELEPHONY from various points indicates that Independent telephone men should not disarm and go to sleep under the impression that the Bell-Western Electric combination has entirely withdrawn from their field. As strongly emphasized at the time the Bell factory announced that it would not solicit business from Independent trade, it is unwise to place implicit confidence in such promises, for all Independents well know that all Bell statements should be taken with more than a grain of salt.

The pressure of righteous indignation against the Bell unfair competition, which was finding expression in appeals to the government for relief, made it convenient for the Bell to ward off attack by pretending to withdraw from the field it was crucifying by unfair tactics. It then planned to go into court and claim immunity by pointing to a change of policy.

Within a week after the Western Electric issued its notice, one of its salesmen was at Portland, Ind., striving to obtain an order from the Independent company at that place. A few days later two Western Electric men were at Richland Center, Wis., working hard to get the contract to furnish a common battery switchboard for the local company, as though the entire future of the Bell organization depended upon their wresting this one job from Independent manufacturers.

On June 30, a Western Electric salesman solicited business from an Independent company at Watkins, Minn. There was a switchboard deal pending at Richville, Minn., a few days later and a Bell factory representative showed up on the job and did his best to land the order, which, however, was given to an Independent firm.

These cases lead one of our informants to say: "It looks as though the Bell was at its old game of telling falsehoods and double-dealing in order to quiet its opponents who were making it too hot for the Bell-Western Electric combine.

"The only thing for Independents to do is to keep up the fight and carry the issue to every branch of the government which is likely to give us relief from this unfair competition. The Bell officials know that they haven't a leg to stand upon if the matter ever gets to an adjudication. A public service corporation cannot sell merchandise to its competitors and at the same time deny those competitors the right to sell to itself. That one-sided condition will not hold water."

Independent manufacturers and operators should continue their battle for their rights and abate none of their vigilance because the Bell factory talks of withdrawing from the Independent field. The supply dealers, too, are finding that the Bell factory men are still active. A big influx of Bell business has induced the Western Electric to go slow in some sections, perhaps, but the feeling is strong that the latter will not voluntarily retire from the competitive field unless absolutely forced to by fear of the law.

Old offenders find it hard to reform overnight. Only the compelling hand of the law keeps corporations like the Bell company within bounds. It is up to Independent telephone interests to see to it that their ancient enemy is made to give them a square deal. Eternal vigilance is the price of a square deal when you are facing the Bell crowd. And, by the same token, *it is always wise to face them.* If you turn your back, you are likely to feel a knife between the clavicles. An unsuspecting back is a target that the Bell can seldom resist.

Give Ambition a New Bone to Gnaw

By HERBERT KAUFMAN

Arkwright, an illiterate little Cockney barber, found time between shaves and haircuts to discover the needs of the weaving trade and produced the spinning jenny which completely revolutionized the manufacture of fabrics. Morse was a portrait painter of sorts, but training for one vocation didn't absorb all his ideas, among which was the notion of communication by wire, otherwise we might have never had the telegraph.

Berliner, a young German from Hanover, began life keeping books in a two-by-four Washington dry goods store and employed his evenings puzzling out the transmitter upon which the development of the telephone is largely based.

Daniel Drew started out as a cattle-driver and wound up as a railroad king. Jay Gould was one of the most persuasive peddlers who ever sold clocks from door to door. John H. Patterson was a coal merchant until he began to think of cash registers. Henry Ford was still running an engine at day wages when middle age and the automobile occurred to him.

What are you thinking about besides your regular line of work? The roomiest thing we know is a man's head. Columbus had space in his sufficient for a new world. Carnegie's skull was large enough to accommodate a square mile of steel mills. Other men have sailed ships and built transportation systems in their brain pans. George Pullman after carpentering hours, grew a palace-car works under his hair roots.

Who knows how many possibilities are imprisoned in your brain cells—let 'em out! Don't wonder how the other fellow managed to do it, but ponder instead what you may accomplish by tackling another subject. The outside viewpoint is frequently an improving new point.

Most men tumble haphazardly into the first job that presents itself, instead of sifting out the occupations best adapted to their bents. If you haven't gotten anywhere—you're on the wrong road. Try another train of thought and keep changing the route until you find yourself. Give ambition a shift of scene.

Education helps, of course, but determination and constructive curiosity are first rate substitutes for a college training. Half the stuff in text-books was thought out by men who tutored themselves to discovery. Study courses are mainly reviews of the work and works of plodders with gumption enough to look around without a guide. Illiteracy isn't necessarily ignorance.

The graduates of the University of Action have endowed civilization with most of its essential requirements. Foundries and shipping rooms, freight cabooses and car platforms, office desks and barn yards, are lecture halls in which progress is continually presenting objects for study.

The men who produce the tools you use, and the articles you handle in your daily affairs get short sighted after a while and believe that they've accomplished the utmost in their lines. But you get an altogether different standard of measurement as a handler of their product and are quite apt to hit upon a change in the shape or form of an implement or device simply by giving your fancy free play and figuring out a difference from the attitude of a user.

Housewives, clerks, farmers, lawyers, even laborers, are daily filing valuable patents on contrivances of their own conception. Stores secure some of their most helpful hints in management from the suggestions and grievances of their customers.

When you next feel like registering a complaint against a public service corporation, or the laundry, or the hotel, or your merchant, pause first and consider the chance of instituting a superior method. If you're not satisfied, a great many others may not be and dissatisfaction with existing conditions is just one of the ways that fortune has of calling attention to opportunity..

Remember the woman who pricked her finger until she saw the point of the safety pin.

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Organization and Management of the Medium Size Systems

Discussion of the Qualifications of Managers for a Telephone Company and Their Supervision—The Construction Department and the Manager—Exchange Duties—The Service and Its Relation to the Returns to Stockholders—The Employes' Wages

By a Progressive

The tendency of the times in Independent telephone circles at present seems to be toward standardization of equipment and better organization of working forces. Independent operators are giving more attention to these matters than formerly, especially those operating the larger systems. The larger Independent systems have not neglected this matter of organization and have built up many efficient systems. As an example, one of the papers read before the convention of the United States Independent Telephone Association in Chicago last December, gave a graphic illustration of the very efficient organization of the Lincoln Telephone & Telegraph Co. which operates a large system of telephone exchanges in Nebraska. This paper appeared in TELEPHONY of March 4, 1916.

While this may be said of many of the large telephone systems of the country, there are many of the smaller systems among the Independents which have grown up in a more or less unorganized way. Experienced men were very scarce when the telephone industry was new, and those in charge of this work were getting their experience during the process of the construction of their plants. We have now reached a point where new construction takes second place in importance to maintenance of the plant; more time and thought must be expended in building up more efficient working systems for operating the plant.

In order to bring this matter down to the class of plant which we wish to consider, all Independent telephone systems will be roughly classified under three divisions.

First, the small Independent or mutual company, operating from one to three or four small exchanges, having as the principal object of its existence cheap telephone rates. To talk of organization or system for these plants is wasted effort.

In the second class are Independent systems operating exchanges in a group of adjoining towns, or covering the towns and cities of a county. There are many such systems operating from five to twenty exchanges.

The third division includes the larger systems of exchanges as well as the large city exchanges. These systems are naturally handled by an organization of trained men, and are alive to the need and development of system.

Companies operating a telephone system of the kind covered by the second class are usually stock companies, the stockholders being represented by a board of directors, who in turn employ a general manager or superintendent to have charge of the operation of the plant. Now it would be a great opportunity, if it were possible, to address a few words to the directors of these companies on the subject of selecting a general manager for a telephone system.

THE GENERAL MANAGER.

A general manager for a telephone system should be a *trained telephone man*—that is, a technically trained man. Directors of many telephone companies will not accept this statement as true in their case, for these reasons:

The directors of a telephone company are primarily interested in their company as a financial investment, and are really concerned with their company only as a business proposition. In order to secure the safety of their investment, these men feel that they should have at the head of their company a conservative business man—one who is financially interested, himself, in the success of their company. They usually realize that such a man may not be technically acquainted with his work but they put forth the argument that as they will employ good men as local managers for their exchanges, a trained man as a general manager will not be needed.

When we stop to consider what this means to a telephone system, is it any wonder that the rural telephone industry has not been brought up to a very high plane of development, and that a *lack* of systematic operation is the predominant characteristic in many rural systems?

Consider some of the results secured by adopting a plan of management as outlined. The average business man who is usually selected as general manager in a case of this kind, is a man who has been successful in some other business and wishes to retire from the work in which he is trained and which has had the best years of his life. Such a man will qualify as president of a company, but the chances are ten to one that he will not be a success as a manager. Why? Because not more than one man in ten has a sufficient amount of the trait we call "adaptability" to master the details of a complicated business after middle life.

Very few men have the energy at that period in life to attack such a job and handle it successfully. Of course, any good business man is able to take up a position of this kind and be moderately successful. But successful management really means building up an efficient organization, not only financially successful, but building up a first class plant, built by standard methods of construction, with office equipment adequate to meet the needs for which it is installed, and using standard methods of operation all the way through the system. This is work of the highest order and is what Independent telephony is greatly in need of.

THE LOCAL MANAGER.

What will be the result in the plan under consideration, of selecting good men as local managers and putting it up to these men to bring success to their company? The success of ten men, or twenty men, in this capacity will vary in all degrees from efficient management to failure.

Take the cases of two men who were employed by a telephone company as local managers on two of its exchanges: These men, with practically no experience, started in communities affording about the same conditions, and developed telephone exchanges of about the same size.

One man developed organizing ability and built up a plant which was neat and well constructed everywhere. He had an operating force that gave evidence of training and supervision, and he handled his exchange in a business-like way. This exchange was the best piece of property his company owned, outside of the head office. The money put into this exchange was practically the same as was put into the other exchanges. This manager knew how to use the material he had to work on, and he produced results.

The other manager was not a very energetic man and accepted conditions as they were. He built his lines as telephone lines were built when he started in the business. He managed, in one way or another, to keep the business going, without exerting himself too much. Naturally his exchange in a few years' time was in bad condition. When it came to a point where subscribers would not stand for the poor service longer, his company had to send in someone who knew how, to rebuild.

This man never drew as large a salary as the other manager. Had he received no pay at all for his work, he would have been an expensive man for his company.

The cases of these two men show the results of putting a man on an exchange and leaving the work of managing it entirely to his judgment.

The Need of Supervision.

A custom, almost unbelievable but done in many places, is that of placing a man in charge of a telephone plant, worth from $5,000 to $25,000 and allowing him to run the exchange for years almost absolutely without supervision, except possibly on the one item of collections. It is not known whether the plant is being improved, just simply kept up to an average condition, or allowed to depreciate into a condition which makes it almost worthless.

This is one of the most discouraging conditions which confronts an exchange manager who is doing good work and knows that he is putting his exchange in better condition each year instead of allowing the plant to deteriorate. It is disheartening to a man to build up his exchange by good work and conscientious effort, and find that the officials of his company are hardly enough interested to really find out what he is doing. This is especially true when other exchanges of the company are poorly managed and the work neglected. The managers of these exchanges, to all appearances, are in just as good standing with their company and receiving just as much credit for their management as the man who is handling his exchange in a much more capable and business-like manner.

There is just one thing which will prevent the exchanges of a telephone system from getting into the various conditions just mentioned. That is intelligent supervision.

Exchange managers are, as a rule, anxious to handle their exchanges well. They want to do their work in a way that will please their officials, if they can find out what that way is. It is a practical impossibility for a man operating a small exchange to learn the best methods to follow in the many departments of telephone work, even on a small exchange, and he should have the benefit of the accumulated experience of his telephone company as a whole.

Supervision of each manager and his methods of doing his work, will show where he needs instruction, and his faulty work may be corrected before his exchange suffers very much on account of his inexperience. This is where the active and thoroughly competent man is needed. The title or position of such a man is not so important as the fact that every small system of telephone exchanges has such a man. He has time enough and authority enough to learn how his system is run in detail, and can give the system an efficient organization.

Two plans suggest themselves for securing such supervision in a small system in which there is not a very large margin between the income and the running expenses.

First, employ as general manager a trained telephone man to act as business manager and also supervisor of the local exchange managers.

If this is not possible, the second plan would be to employ a man as president of the company to act as a financial business manager, employed but part of his time in this work. Then employ a superintendent of plant or inspector of exchanges, who knows the details of telephone work and who has some ability as an organizer.

Reorganizing the Construction Department.

In the construction department, it is customary for each exchange manager to look after the line construction of his exchange. To do this, he must organize a crew for a part of the summer, and it is usually a difficult matter to find linemen or line foremen in a small town. The usual crew for this kind of work found on small exchanges, is made up of the manager, when he can get away from other work, the troubleman part of his time and one or two men who are starting as apprentice linemen.

It is impossible to get good construction under such conditions. A better plan is to organize a construction crew, under a competent foreman with a good means of getting about, preferably a motor truck, and let this crew do all the line construction for several exchanges. Organize enough crews of this kind to cover the territory of the system and keep most of these men employed the year through. By this plan good work will be done and it will not be as expensive, considering results, as this kind of work in the way it is done at present in many places.

The next matter of importance in this connection, where supervision is needed, is in planning *where* new construction or rebuilding should be done, and *how* it should be done. The telephone company should decide how much money it wishes to put into construction work each year, and apportion this amount among the exchanges of the system—rebuilding lines where rebuilding is most needed, and when a piece of work is done, doing it only in a first class way.

Many companies allow their exchange managers to rebuild any part of the plant which they wish, and at any time they wish. In fact, they do not interest themselves very much in the question of what their managers are doing. Indeed, local managers have often received credit for economical management when they were doing no rebuilding at all for a period of several years. Then the men who have given credit for such management are amazed to learn that these plants are in such a run-down condition, and so badly in need of rebuilding.

The Planning of Construction Work.

To facilitate this work of planning construction and rebuilding of lines, a telephone company should have blueprint pole maps of all its lines. These pole maps are a great help in organizing the work for the construction department. When a section of line is to be reconstructed, a print or drawing covering the part of the line in question can be taken from the exchange pole map, with instructions which will show exactly how the work should be done. This drawing and instructions can then be given to the foreman who is to do the work.

This idea of planning line work and issuing instructions in detail to foremen, may seem to many Independent telephone men as entirely unnecessary, as they have gone along without anything of that kind for years. The large telephone companies, however, spend many dollars each year on this kind of work. If it is worth while for them, why is it not worth while for a smaller company?

Adopting a plan of this kind will have two beneficial results. Having an experienced man go over the plans for new work will help to prevent errors in the plans; for instance, using cables which are too small for the needs of a territory, or rebuilding heavy leads with material which is not heavy enough.

Then if plans for new work are made by someone from the head office of a telephone company, the men in authority will know how much a piece of work is going to cost. It often happens under old methods of handling work of this kind, that orders are given to do a piece of work. Afterward complaint is made because it is costing so much to do it, and the blame is put on the manager or foreman for the high cost. By making definite plans and an estimate of the approximate cost of a job, such a thing may be avoided.

Another place where the exchange manager needs supervision, is in the maintenance of office equipment. The proper care of the switchboard, cross-connecting rack, and the batteries, is important in keeping up the service, and the man who has charge of this work may need some instruction. Many companies have no plan of learning whether or not the office equipment of their outlying exchanges is properly cared for. To illustrate this fact, a local manager, responsible for the switchboard repair work of his office, found out that a representative from the headquarters of his company, would be at his office in an hour on a business trip. This manager had been neglecting to repair the cords on the switch-

board, and 12 pairs of cords out of a total of 36 pairs were out of order. To prevent the operators using these bad cords each cord had a knot tied in it, just below the plug.

Of course, this would not make a very good showing for this man's repair work and, as he did not have enough time to repair the cords before the arrival of his visitor, he had to resort to emergency measures. He simply untied the knots in the cords until after the visitor had gone.

This neglect in repairing switchboard cords and keys is a common fault in small offices. Every company should have some plan of inspection or reports to show how this kind of work is looked after.

Uniform System for Line Records.

The cable and line records of a small exchange are other matters which needs supervision. As small exchanges are run at present, some offices have no records, some have scant and neglected records, while others have very useful and satisfactory records.

A telephone company operating more than one exchange, should adopt a workable plan of cable, line, and instrument records, which is adequate for their needs, and keep the records at all exchanges in the same way. This plan makes it an easy matter for a man employed on a system to work on any exchange and easily look up any information desired in regard to cable and line circuits.

There is a great deal of time lost by a new man in an exchange which does not have a good set of records. When any question of line facilities, or need of extensions at any point, comes up, properly kept records will show information at once, which would require much time to obtain if no record is at hand.

Proper Training for Operators.

The proper training of switchboard operators is one of the most important matters before Independent telephone companies at present. There is no question of the need of the average operator on a small exchange for training in more uniform and better operating methods. The question is in regard to the best method of giving her the necessary training.

When an office is large enough to employ three or more operators at one time, the question of supervision simplifies itself. In offices of this size, a chief operator or supervising operator may be put on at least a part of each day, to act as a supervisor over the operators. It is not difficult to secure one or two competent operators for this work in any office, and when she has a little experience in this kind of work and also some competent training, good results are sure to follow her efforts. She will be able to enforce some simple rules of operating which without supervision will be constantly violated.

There are many offices where two or three operators have all the work they can handle, and more than they can do justice to. The reason is that the number of subscribers is not increasing in a manner to justify the management in adding another position to the switchboard. This is false economy if we consider service. By adding a position to the switchboard under such conditions, great advantages are offered for relieving and improving the service. It gives an opportunity to put on an extra operator during the busy period, and provides facilities which are greatly needed for breaking in new operators. A good plan is to allow the chief operator to do this relief work during rush hours, and occupy herself as a supervisor the rest of her time, giving needed instruction to the regular operators.

In small offices having but a one or two-position switchboard, the matter of proper supervision and training of operators is more difficult. As an extra girl to act as supervisor is out of the question, the only alternative is to train each operator so that she will not need constant supervision. This is not an easy matter, as in a small office having but one or two operators on duty at a time, with relief operators on duty but a short time each day, rules are easily forgotten and proper methods neglected.

In a small system having several small offices, these difficulties may be partly overcome in two ways:

First, by conducting a training school for operators at a central point, once or twice a year, each session lasting several days. It is practicable to operate a small office with half the force off duty for a short time, so the course of instruction may be repeated and half the operating force of each office attend each session.

The second method is supervision by someone from the head office, who keeps in touch with the work of all operators, *requiring* each operator to do her work properly. The knowledge that the officials of a company will require its operators to do their work properly, will do a great deal to keep up the standard of efficiency in the smaller offices. When an operator never hears of better methods of operating, and thinks her employers are satisfied with her work, there is no incentive to try to improve.

Returns vs. Improved Service.

Some of the ideas discussed may be considered as unnecessary, or as costing too much to be considered. Improved methods will cost money, but the improved service will be worth the additional cost.

Stockholders and directors of stock companies must realize that there are two phases to the operation of a telephone system as an investment. There is the question of returns on the investment and there is the question of *operating* the plant.

It is natural that a stockholder should consider the matter of returns as the most important one with which he is concerned in his connection with the telephone company—and it *is* an important matter. When money is invested in a business enterprise the investor is entitled to a fair percentage of return on his investment. The operation of the plant, however, is really a more important matter than the matter of revenue, for the reason that the revenue is dependent on the way in which the plant is operated.

A stockholder should be satisfied with a reasonable rate of interest on money invested in telephone stock. In the early days of the Independent telephone industry, there was a certain element of hazard in the investment of money in telephone stock. This hazard justified a stockholder in demanding a high rate of interest on money invested. Time has brought about a change in the conditions under which almost all Independent telephone companies operate at present, and the element of risk is no longer to be considered. Independent telephone stock is as permanent and safe an investment, under existing conditions, as any investment which may be made in this country.

The public service commissions of the various states protect an operating company from new competition and insure a fair rate of return on money invested.

When we consider these things, it would seem a wise policy for a stock company to pay dividend not exceeding 6 per cent. on money invested, until the physical plant of the company is built up in a good substantial manner, and an efficient organization provided that will insure a reliable service to the patrons.

If the rates of a company are not high enough to permit the company to put the plant on a substantial basis, it is justified in going before its commission and asking the privilege of increasing the rates. But if a company is paying its stockholders a high rate of interest, and is not able to put its plant in good condition, or operate it as it should for good results, then the force of its argument for higher rates would not have much effect.

Employes' Wages.

An important matter to be considered in building up an efficient organization to operate a telephone company, is that of wages. A telephone company which pays its stockholders

a high rate and pays its employes the lowest possible wages, is unjust. If an employe is at all satisfactory, he or she is entitled to wages which will make it possible to *live* and pay their way, without living off of their relatives, and be reasonably well satisfied with their positions. No company should expect to secure good results, or hold employes who are desirable, when linemen are paid $2 per day and operators $20 per month, or wages on that basis. Higher wages and shorter hours are reasonable reforms which are bound to come in all states, and some states have already passed laws toward this end.

It is much better for a telephone company, as a business policy, to be progressive and stand in the front rank of those corporations which are willing to adopt better pay and an eight-hour day for all employes, than it is to fight these things.

A conservative policy of business management for any business is a wise policy, to a certain extent. A business concern should, however, be progressive enough to adopt any plan for improvement which will put its business on a firmer basis.

The Rising Cost of Manufacturing Materials.

A. L. Salt, vice-president and general purchasing agent of the Western Electric Co., in the current issue of the Western Electric News, states that the present purchasing power of one dollar, as compared with what it was August 1, 1914, is about 48.6 per cent. In other words, today's average cost of the following commodities is $1 as compared with 48.6 cents before the beginning of the great European struggle:

Material	Increase
Acids	15 per cent
Aluminum	108 per cent
Antimony	533 per cent
Batteries, dry	68 per cent
Brass, rod and sheet	174 per cent
Copper	126 per cent
Dyestuffs	200 to 2000 per cent
Fibre	113 per cent
German silver	105 per cent
Hardware, pole line:	
Cross arm bolts	175 per cent
Cross arm braces	274 per cent
Guy clamps	160 per cent
Lead, pig	94 per cent
Lumber	20 per cent
Paper, cable	70 per cent
Platinum	98 per cent
Rings, Aerial	39 per cent
Rubber, crude	39 per cent
Silk, spun	65 per cent
Silk, tussah	36 per cent
Spelter	216 per cent
Steel, Bessemer billets	123 per cent
Strand	77 per cent
Thread, linen	158 per cent
Tin	66 per cent
Tinsel	25 per cent
Vermillion	167 per cent
Vitriol, blue	329 per cent
Wire, iron telegraph	20 per cent
Wire, outside distributing	19 per cent
Wire, bridle	35 per cent
Wire, inside	27 per cent
Yarn, cotton	27 per cent

These figures are based on market values of each item over a period of approximately 20 months, and can be traced principally to the following causes:

(1) Decidedly increased requirements in Europe of hundreds of items which cannot be supplied there.

(2) Enormous orders placed in this country by European powers for war munitions, motor vehicles, horses, mules, uniforms, foodstuffs, machinery, leather products, iron and steel, etc.

(3) Imports and exports curtailed by embargoes and other restrictions making it difficult, and, in some cases, practically impossible, to obtain certain materials from abroad.

(4) Suppliers loaded up with orders in the execution of which they are unable to obtain machinery and tools.

(5) Transportation facilities taxed to the limit necessitating freight embargoes and causing long delays in transit.

Data from Bradstreet's shows that on 13 general headings embracing 106 commodities, the average increased cost is approximately 34.2 per cent over August 1, 1914, as follows:

	Aug. 1, 1914	June 1, 1916	
Breadstuffs	.0913	.1093	20 per cent
Live stock	.4700	.4755	1 per cent
Provisions	2.2438	2.5248	12 per cent
Fruits	.1647	.2511	52 per cent
Hides and leather	1.3800	1.8550	34 per cent
Textiles	2.3829	2.9973	26 per cent
Metals	.5542	.9626	74 per cent
Coal and coke	.0067	.0079	18 per cent
Oils	.3585	.5224	45½ per cent
Naval stores	.0792	.0709	*10 per cent
Building materials	.0822	.1087	32 per cent
Chemicals and drugs	.6046	1.4945	147 per cent
Miscellaneous	.2906	.3087	6 per cent
	8.7087	11.6887	34.2 per cent

*Decrease.

"It will be noted, however," Mr. Salt states, "that this last table contains a great many items which are not included in our list, on which the present purchasing power of one dollar is somewhat greater than our figure.

"It is a fact that the country's industries for more than a year—that is, since the outbreak of hostilities—have been at their wits ends to keep consumers supplied, due to the unprecedented demand for material of all kinds—especially the classes entering the arts. The cost of real necessities of life, however, and even some luxuries, has not increased to anything like the same extent, notwithstanding the fact that they are surrounded by similar conditions of consumption at home and abroad, and on such items we find that the present purchasing power of a dollar more nearly equals that prevailing before the war."

New Exchange Building Under Construction in Brooklyn.

The New York Telephone Co. has just started work on a new fireproof central office building at the southeast corner of Gates and Fairview Avenues, Brooklyn, N. Y., to house the Evergreen telephone exchange. The building will be completed in December, and new central office equipment is expected to be installed and ready for use by May, 1917.

The new building will be large enough to care for a 10,000-line switchboard and can be extended to the side and to the rear and enlarged to provide for a second central office when necessary. The initial switchboard installation will consist of 6,000 lines.

Chicago Telephone Earnings For May.

The Chicago Telephone Co. reports 525,758 stations in service on May 31, 1916, an increase of 45,933 over the preceding year. The total operating revenues for the month of May were $1,630,881, an increase of $172,625 over the same month in 1915. The operating expenses amounted to $1,194,649, an increase of $172,158. This left an operating income of $334,759, a decrease of $15,793 over May, 1915.

St. Helens (Ore.) Plant Sold to Bell.

The St. Helens Telephone Co., of St. Helens, Ore., on June 2, sold the St. Helens exchange, including all country lines, to the Pacific Telephone & Telegraph Co., the latter company taking immediate charge. Leo. J. Conlin has assumed the management of the exchange for the Pacific Telephone & Telegraph Co.

"Telephony's" Home Study Course for Telephone Men

A Complete Presentation of the Principles Underlying Modern Telephony in All Its Branches—Arranged Systematically So That Regular Reading and Faithful Study Will Qualify Ambitious Men for Higher Positions—Prepared Under Supervision of Stanley R. Edwards—This Section Written by Jay G. Mitchell

Quiz Questions on the Preceding Installment.

425. What is the differential relay?

426. What is the relation between the two windings of the differential relay, Fig. 150, and the other elements of the telephone line when the subscriber is calling the exchange?

427. Give the reason for the inequality of resistance in the two windings of the differential relay.

428. What function is performed by relay *E* in Fig. 150?

429. What condition is represented by the resistance arrangement shown in Fig. 151?

430. Explain in your own words the effect upon the circuit conditions of the insertion of the answering plug in the answering jack.

431. Why does the differential relay operate when the answering plug is inserted into the answering jack?

CHAPTER XIX. Typical Cord and Line Circuit Combinations (Continued).

432. *Battery current feed in differential relay line circuit combination.*—It is very interesting to note that the cord circuit for use with the differential relay is not connected to positive battery on one conductor and to negative battery on the other. Both sides of the cord circuit are connected to the non-grounded terminal of the common battery. This means that some method must be included in the line and cord circuit combination in order that there may be a proper supply of current to operate the transmitters of the connected telephones.

The flow of transmitter supply current starts from the non-grounded terminal of the common battery, out through the winding of the supervisory relay, *C*, to the sleeve conductor of the two-wire cord. Thence the transmitter supply current passes to the telephone over the sleeve side of the line, returning over the tip side and reaching the grounded terminal of the common battery through the front winding of

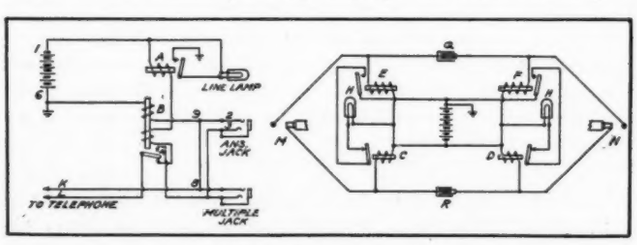


Fig. 150. Differential Relay Line Circuit.

the *differential relay*. It is necessary, therefore, that the inductance reactance of this winding of the differential relay, plus that of the relay, *E*, should be equal to the inductance reactance of the supervisory relay, *C*.

The front winding of the differential relay is not a significant element of the feed to the transmitters, as the operation of the differential relay armature *removes* this winding from the circuit. The strength of the current flow over the telephone circuit from the relay, *C*, and back on the other side to the front winding of the differential relay, *B*, might, however, not be sufficient to retain the armature of relay, *B*, in the operated position by magnetic attraction, were it not for the additional current flow supplied through the winding of the relay, *E*. This serves to maintain the current through the front winding of the differential relay, *B*, at a sufficiently high value to retain its armature in the operated position as long as the plug, *M*, is in the jack.

Were this not so, the variable current caused by all the various operating circuit conditions on long lines might so weaken the magnetic flux in the core of *B* as to release the armature. This, unless prevented by the current flow through *E*, would have the instant effect of opening the line circuit at the armature contacts of *B* without there being any possible way of closing it again. In other words, leaving the flow of current through the relay, *E*, out of consideration, the relay, *B*, becomes a self-locking relay and when the circuit over which is secured the energizing flow of current, is once broken, it is not possible to re-establish it in any way. All possibility of the occurrence of this kind of trouble is obviated by the presence of the relay, *E*, in the circuit.

In the particular, that one element of the battery feed is a part of the line equipment and *not* of the cord equipment, this circuit is different from all the others considered.

433. *Distinction between differential and double-wound line circuit relays.*—The use of the two windings on the differential relay, *B*, should not be confused in any way with the use of double-wound *line relays*, which is quite common. The use of the double-wound line relay has for one of its objects reduction in the click in the ear heard by the calling subscriber when the operator inserts the answering plug in the jack. In no way, ordinarily, is the use of two windings dependent upon the differential effect required for the operation of the line circuit shown in Fig. 150. (See Editor's note at end of this installment.)

It is perfectly evident that the cord circuit is, when considered in conjunction with the front winding of the relay, *B*, of the condenser balanced-impedance type with the battery feed impedances wound upon separate cores.

434. *Line circuits of the two-wire and three-wire multiple varieties.*—There have been a few switchboards installed in which the differential relay principle is used with a line circuit of the three-wire multiple variety. There is no additional principle involved and the three-wire circuit with this

equipment presents no advantage over the two-wire multiple.

435. *Another application of the differential relay principle.* While the differential relay principle is not widely used in telephone circuit design, except as shown, it affords a very instructive example of the effect of two opposing magnetizing forces acting upon the same iron core. A special circuit designed and installed by the writer some years ago included a relay of this type in an arrangement differing somewhat from the telephone switchboard circuit described. This arrangement proposed to furnish night watch reports and fire alarm service over the telephone wires.

The telephone circuit over which the special service was to be given, was cut and one winding of the relay inserted in each side. Connected into the circuit in this way, it was necessary for the telephonic voice-carrying currents to pass through both the windings. By properly connecting the winding terminals, the two magnetizing forces were made to oppose each other when there was any current flow in opposite directions over the two sides of the circuit (Fig. 152).

It is true that each winding in a relay connected directly into the telephone circuit in this way, must have precisely the same reactance as the other one. When the two windings are equal in this respect, the entire relay becomes merely a non-inductive resistance causing only such transmission losses in the circuit as may be ascribed to the insertion of its ohmic resistance in the line and therefore in the transmitter battery feed.

436. *Manufacture and circuit connections of special differential relay.*—Special precautions are required in the manufacture of such a relay. The two windings must be placed upon the spool simultaneously so that they possess exactly the same electrical and magnetic characteristics in every way. In winding, two wires are fed to the spool at the same time, one for each of the two windings.

When the relay is installed, the two windings are connected into the circuit as may be necessary, but in any event there must be exact equality between them. This is obtained because each part of the length of one wire will be alongside an exactly similar part of the length of the other one.

Each coil will have exactly the same number of turns as the other one; will occupy the same position relative to the core; and will have the same magnetic leakage to overcome. With such a relay it is perfectly possible to send the telephonic voice-carrying currents through the coils, provided they are so connected that the magnetic effect of the one is opposed to the magnetic effect of the other. In other words, the current flow in one coil must pass around the iron core in the opposite direction to that in the other.

If this is true, it is immaterial whether the currents passing through the coil windings are direct or alternating. If the current is alternating, the effect in one coil at *any given instant* is exactly neutralized by the effect in the other one at the same instant. The entire relay will have the effect of a strictly non-inductive resistance included in the telephone circuit. See section 287 TELEPHONY's Home Study Course for Telephone Men, January 15, 1916.

Now if both sides of a telephone circuit having such a relay connected in series be grounded outside of the central office, the resulting flow of current from the grounded common battery through the two coils will not be of equal strength. The winding inserted in that side of the circuit connected to the grounded terminal of the battery, being connected to ground at both ends, will carry practically no current. The winding in the side of the circuit connected to the non-grounded terminal of the battery will carry such strength of current as the circuit resistance conditions will permit to pass. The relay core will be magnetized by the magnetizing force of the coil that is carrying current, and the relay will be operated as intended.

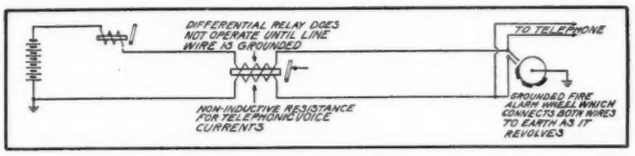

DIFFERENTIAL RELAY DOES NOT OPERATE UNTIL LINE WIRE IS GROUNDED
TO TELEPHONE
NON-INDUCTIVE RESISTANCE FOR TELEPHONIC VOICE CURRENTS
GROUNDED FIRE ALARM WHEEL WHICH CONNECTS BOTH WIRES TO EARTH AS IT REVOLVES

Fig. 152. A Special Circuit Using Differential Relay.

With the arrangement shown, this will be true of the differential relay whether the telephone line happens to be in use at the time or not. Should the line be in use and should there be a cord connected by a plug to the line jack, the battery current supply for the transmitter would serve to operate the differential relay in the same way as the current flow from the line relay circuit would operate it when the line is not engaged. The general relation of such a relay to the ordinary common battery telephone circuit is shown in Fig. 152.

(To be Continued.)

[EDITOR'S NOTE: Owing to an oversight in the drafting department, the circuit in which the differential relay appears in Fig. 150, is slightly incorrect. The tip and ring springs of the jacks are reversed. The long spring should be connected to the wire now leading to the short spring and the latter connected to the wire leading to the long spring. A careful reading of the description will at once disclose this error. The description is correct, the drawing, in this particular, being incorrect.]

Conference of Central Home "I Told You So" Club.

Louisville, Ky., will be headquarters for telephone enthusiasm on July 22, when the "I Told You So" managers, both district and plant, of the Central Home Telephone & Telegraph Co., will assemble at the Louisville headquarters for one of the periodical general conferences. Incidentally they will celebrate another 100 per cent. collections' record and those who are entitled to them will receive the cash prizes. Several business sessions will be held to be addressed by the officials of the company and for round-table discussions of means and methods for carrying on the good work. Each of the managers will give the practical conclusions he has arrived at through his experience and observations.

To Use Telephone in Distributing Weather Forecasts.

In parts of the West the United States Forest Service is co-operating with the weather bureau in distributing weather forecasts to the settlers. By the use of Forest Service telephones many isolated sections are reached which could not otherwise receive the reports. Sheepmen owning bands of lambing ewes will be particularly benefited, as the warnings enable them to get their sheep under shelter and avoid the losses sometimes caused by late spring and early summer storms.

Importance of Costs in Valuations and Rate Making

Methods by Which Cost of Service Is Determined—Allocation of Such Costs Among Different Classes of Subscribers—Growing Importance of Cost Basis of Rate Making—Paper Presented at Convention of Wisconsin State Telephone Association

By Halford Erickson

The law provides that the rates charged public utilities for the services they render shall be reasonable under the circumstances. The law also defines in various ways what is meant by reasonable rates. Without going into details upon this point it may be said that under normal conditions a rate schedule in order to be equitable should yield returns that are sufficient to cover reasonable allowances for operating expenses, including such fixed charges as depreciation and interest, and profits on the fair value of the property and business employed in the service.

The law further provides that the total amounts which thus constitute reasonable charges for the service, when taken as a whole, should be so distributed among the different branches of the service and between the customers therein that each of them is required to bear a fair proportion of the total charge. When these and other provisions of the law are more closely examined, it will be found that the expenses and fixed charges mentioned become the cost of the service and that this cost, when conditions are normal, also becomes a fair basis for the schedule of rates.

It follows from this that in order to find the proper basis for rates it is necessary to determine what constitutes reasonable amounts for such operating expenses, depreciation and interest charges. To accurately determine the reasonableness of such charges as these is by no means always an easy matter. Interest and profits depend upon the cost value of the property and business used in the service and the cost at which such capital can be had. Depreciation depends on the cost of this property and on the length of its useful life. The operating expenses proper depend largely upon the cost of labor and material of all kinds and upon the efficiency of the management.

As the charges for interest and depreciation make up a large proportion of the total cost of the service and as the records of the utilities are seldom so kept as to show the fair value of the property involved, it is often necessary in fixing rates for a utility to also appraise its property and business. In making such appraisals much guidance is obtained from the conditions which prevail in the competitive field. Under free competition, for example, it is found that the value of the property used in production tends to equal the cost at which such property or capital can be had. On the same basis the fair value of public utility property, when these utilities are operating under normal conditions, may be defined as the normal cost of obtaining the capital or property needed.

Two Kinds of Value.

Value originates in the wants of man. These wants may be satisfied by commodities and service. Commodities and services which satisfy such wants are said to possess utility and are much sought after. When such commodities are scarce and cannot be had without labor or sacrifices of some kind, they are also said to have value. Value is usually said to be of two kinds, subjective and objective. Subjective value is the value attached to a thing by an individual. Objective value is the so-called exchange value or the price at which goods and services are exchanged in the market. It is mostly with exchange value that we are concerned here.

Under free competition, value or price is largely fixed by supply and demand, and the value or the prices thus fixed tend to equal the expenses of production, when these expenses include ordinary operating expenses, and reasonable returns for fixed charges upon the investment. When in any line of competitive business prices yield more than this, additional competitors enter the field, the effect of which is to increase the supply and consequently to decrease the demand or price. When prices fall below the cost of production, existing competitors tend to withdraw from the field until the supply is reduced and the prices raised. It is through the operation of these forces that value or price tends to equal the cost or expense of production. Value fixed in this way is usually regarded as the normal value. It is assumed to be a value that is equitable and fair to all concerned.

Public authorities, in fixing values and prices, should be mainly governed by principles of equity and justice. To that end they rely for guidance mostly upon conditions which obtain under free competition. Normal values or prices such as are fixed by free competitive forces and which tend to equal the cost of production, are therefore largely adopted by public authorities as the bases for the value or price which they fix. As such competitive values are generally recognized as fair, no better standards could probably be adopted. When the normal values as fixed by competition are applied as bases for fixing values of public utilities, the relation upon which values depend are to a considerable extent altered. Under competitive conditions the value of capital, or production goods, is largely determined by the earnings. In the public utility field when values are determined by competitive results, it is the value thus fixed that largely determines the amount to be earned. In the competitive field value thus depends on earnings; in the regulated utility field earnings depend on value.

Cost of Production.

By the term cost of production, as a price regulator in the competitive field, is frequently meant the cost of reproduction. This is especially true when considerable changes have taken place in the cost of production between the time the commodities were actually produced and the time they are sold. This is of the greatest importance. In all probability it is responsible for the fact that courts and other public authorities in determining the fair value of public utilities are guided by both the original cost and the cost of reproduction of the property and business. Reliable facts bearing upon these two costs are therefore necessary in the work of determining the fair value of the property of public utilities.

By original cost in this connection, it seems to me, should be understood the cost at which the existing property used by public utilities in rendering service was acquired. By cost of reproduction is meant the cost of reproducing the existing property under prevailing conditions. The original cost of the existing property should be shown by the books and records of the utilities providing these have been properly kept and are still in existence. When the books have not been so kept or are not available, the original cost as thus outlined may be determined very much in the same manner as that in which the cost of reproduction is found. In order to determine the cost of reproduction it is necessary to have complete inventories of all the material, labor and services that have entered into the plant. To this end it is further necessary to have complete price lists of such material, labor and services covering not only existing prices, but the prices that have prevailed for some years in the past. In the case of prices which fluctuate sharply,

it may also be necessary to weight these prices. Consideration should also be given to the general trend in the course of the prices since most valuations are made for the future as well as for the present.

When the original cost of the existing property is desired, it can be computed upon the same inventory as that used in determining the cost of reproduction and upon prices which cover the period when the property involved was put into the plant. Such price lists may be had partly from the records of the plant and partly from other sources. In this way the original cost of the existing property can be had with even greater accuracy than the cost of reproduction.

Depreciation.

While the original cost and the cost of reproduction as thus outlined are generally regarded as the best evidence of the value of the physical property, there are other factors such as depreciation which also should receive consideration in this connection. Depreciation is a proper charge to the operating expenses and the rates for the service should be high enough to cover this charge. When depreciation has thus been covered by the rates and when the amounts so earned for this purpose have been set aside in a reserve until needed for renewals, it is not easy to see on what ground the depreciation that has taken place in the property can be fairly deducted from the cost of the property or the cost of reproducing it new in determining the fair value of such property for rate-making purposes.

This would also seem to be true in cases where the conditions have been such that it has not been possible for the utility to earn enough to cover depreciation and all other reasonable returns. When on the other hand the rates have been high enough to cover depreciation and when the amounts thus earned for depreciation have not been set aside until needed for renewals, but have been paid out to the stockholders for their private use, then it may become necessary to deduct depreciation from the cost new in fixing the rate-making value. This is at least true when the amounts earned for depreciation have been disposed of in such way that they cannot be made available for renewal purposes.

Among the other factors that should be included is the cost of the business. Few utilities are paying from the start. In order to develop a paying business most of them have to expend money and efforts in various forms. These expenditures constitute a part of the investment that is necessary in order to produce the service, and upon this part of the investment the utility may be as much entitled to returns as upon the investment in the physical property. Such development costs as those I have now in mind are usually embraced in what is usually termed "going value."

Going Value.

The going value as thus explained may be determined from facts which show the original cost and the cost of reproducing the business. The original cost of the business is as a rule disclosed from the records of the utility and can often be determined with a fair degree of accuracy. The cost of reproducing the business is largely a matter of estimates, but from a close study of the facts and conditions in point and through the employment of sound methods in the computations, it is also possible to obtain a fairly good idea of what this cost would amount to.

The physical property and the business are the most important elements in the appraisal, and the fair value of these elements depends very largely upon their cost. What is thus true with respect to the fair value is also true of the operating expenses and fixed charges. These items also depend upon the cost of the elements which enter into them and the cost of these elements, in turn, as already intimated, depends very largely upon the prices of the same in the open market; that is, on prices and conditions over which the utilities have little or no control. This is as true of the rate of interest and profits as it is of depreciation and of the prices of labor and material. The utilities, like persons, must pay the market price for what they need or use or go without it.

In a general way have thus been outlined the methods by which the total cost of the service furnished by the utility is determined. When the total cost has thus been found and when conditions are normal, it becomes necessary to distribute this cost in such a way that each class of customers bear their just share thereof. This distribution is greatly complicated by the fact that a large proportion of the expenses are common to all classes of customers rather than special for any particular class and by the fact that for this reason the former or the common expenses must be apportioned between the classes on bases that are more or less arbitrary. This fact, however, is not often a real obstacle to such distribution. In most cases it simply means that the distribution becomes somewhat more laborious than would be the case if the expenses could be directly allocated to each class of service. Upon closer examination it is usually found that practically all of the common expense items bear so close a relation to some unit or units of the service that they can be fairly apportioned thereon.

The methods that should be employed for such apportionments, however, vary not only with variations in the kind of utility, but with variations in the conditions under which utilities of the same kind are often operating. In order to illustrate the practicability of such apportionments and to point out that the unit costs obtained thereunder may become proper bases for rates, I will briefly outline some of the methods under which the total expense of a telephone utility may be fairly distributed among the different classes of its subscribers.

In this connection it should be remembered that so little has so far been done in establishing the cost of service to various classes of telephone subscribers, that the methods used for such cost analysis are not at all standardized, as they are in the analysis of the costs of electric service and the service of some other classes of utilities. It is frequently contended that telephone rates can not be established upon a cost basis and there appear to be two principal arguments advanced in support of this contention.

Objections Urged to the Cost Basis.

The first of these is, that if telephone rates were to be established in accordance with the cost of service, classes of service which now bear the heaviest charges might be found to have the lowest cost and consequently the lowest cost basis rate. It is frequently argued that with rates made upon the cost basis, business telephone service would take a lower rate than residence telephone service, because of the shorter lines required to reach business subscribers and the consequent saving in interest, depreciation and maintenance of wire plant.

The second objection usually urged to the cost basis is that if rates are to be established in line with the cost of service, the resulting schedule will be one which will not prove satisfactory from a commercial standpoint. In other words, rates will be high for classes of subscribers who can afford to pay only low rates, and the result will be a restricted development of the telephone business.

In connection with these objections to the use of a cost basis for fixing telephone rates it is generally argued that the cost of any individual class of telephone service in an exchange which furnishes several classes, is impossible to determine. The interdependence of telephone subscribers, the intangible nature of the unit which must be used (the call) and other considerations make it impossible to determine, by any process of cost analysis, what the cost is of serving a business subscriber as distinguished from the cost of serving a residence subscriber; or what the cost is of serving a subscriber on a two-party or a four-party line. Were these objections to the cost basis to hold good, they would be sufficiently serious to prevent the general adoption of that system. By examining them in detail

a little more closely, however, it will be found that they are not often well sustained.

When telephone costs are subjected to the proper analysis it will not be found that the cost of serving business subscribers will normally be as low as the cost of serving residence subscribers. If, for example, the unlimited single party business service were to share in central office expense according to its proportion of the traffic and were to share in substation and wire plant expenses only to the extent that those expenses were incurred on lines connecting subscribers in this class with the central office, or on instruments installed on the premises of such subscribers, it might be true that the cost analysis would have a tendency to flatten out the rate basis and disclose a cost for the highest grade of service not materially greater than for lower grades because of the relatively small wire plant investment involved in serving the business subscribers.

It appears, however, that a cost analysis which would assign finally to each class of service all expenses incurred in connection with the up-keep of its station and lines, would be incorrect. To illustrate this, let us assume the simplest case which can be found in the telephone industry; that is, where a party having a store has a private line from the store to his residence with a telephone at each end of the line, but with no connection with any other line or lines. In this case it would be incorrect to say that the line was installed entirely for the service of either party, or even to say that one half of the line is a business line and that beyond the middle of the line, it is a residence line. Rather, it is a line used and useful, in serving both the store and the residence and not more useful in serving one than the other. In other words, it is a combination business and residence line, and the cost of keeping up that line is as much related to the service which is furnished to the residence as to the service furnished the store.

Distribution of Long Line Expense.

Now let us assume that instead of this line running directly from the store to the residence, a line reaches from the store to the telephone central office and another line from the residence to the telephone office. When these lines are connected together for the purpose of carrying on a telephone conversation, the situation is substantially the same as it would be if they had not been connected with the telephone switchboard, so far as that particular call is concerned. That is, the business line and the residence line become for the purposes of that conversation, a combination business-residence line, and so much of the cost of keeping up that line from the store to the residence as may properly be assigned to that particular conversation should be divided equally between the business class of service and the residence class of service. The result of this will be that even if the residence class of service requires longer lines to connect it with the central office, part of the expense of such lines will be borne by each class of service with which connection is secured, so that the business class will carry part of the long line expense of the residence class, and the residence class will assume in turn part of the short line expense of the business class.

The same principle holds true with regard to stations on subscribers' premises. Although we customarily speak of a telephone in Mr. Jones' residence as Mr. Jones' telephone, Mr. Jones makes no more use of that telephone than is made in the aggregate by all the parties with whom he talks, and he makes as much use of the telephones of parties with whom he talks as all of those parties make of his. Consequently it seems that the investment which may in the first instance be definitely assigned to classes of service is really invested not only for those classes, but for the combined use of those classes and all others with whom they secure connection, and that consequently interest, depreciation and the cost of up-keep of such portions of the equipment should be divided between the classes of service for which they were directly installed and all other classes with which connection is secured.

In the telephone field, the same as for other utilities, it is found that of the cost of the service certain items are incurred directly in serving each class of subscribers and that certain items are incurred for the service as a whole and are indirect to all classes of the service. The direct expenses of those items of cost which can be directly allocated by classes of service, include wire plant and substation expenses and charges, the expense of certain parts of the central office equipment, a part of the commercial expenses and other items of this nature. The indirect or common expenses include, among other items, such costs as operators' wages, the outlays connected with that part of the central office equipment which is common to all classes. In addition to these there are also certain items such as general expenses which are administrative in their nature and which are overhead to all other expenses.

Message Telephone Unit.

The direct expenses are as a rule first allocated by classes, and the total cost for each class is then distributed among all users of the equipment in proportion to such use or on what may be called the message telephone unit. The message telephone unit is a term that is here used for convenience and may be described as the use of one telephone in one conversation. The indirect expenses which can not be directly allocated to each class, are so allocated mostly on the basis of the traffic or of the originating and terminating calls and, like the direct expenses, are then distributed among all users in proportion to use or on the message telephone basis.

General expenses, certain commercial expenses, insurance, the cost for certain property and services which are also general in their nature and other charges of this character, are also at times entirely or in part allocated to each class of the service in the same proportions as the more direct expenses and to which they constitute an overhead charge. This method of treating general expenses has been found to be sound for other utilities and there would not seem to be any good reasons why this method is not also fair for telephone companies. General expenses when thus allocated by classes, are also included in the final cost which, as explained, is distributed on the basis of the use of the service or on the message telephone basis.

In order that the total cost of the service may be properly apportioned between those who use this service, it is necessary that the property involved and that which constitutes the basis for the interest, depreciation, maintenance, and taxes that must be met, should be allocated between the different classes of the service on the one hand and that part which is common to all classes on the other. These apportionments can best be made at the time the plant is appraised and by those who are then appraising the same. If, for example, there are two classes of service only, single party business and single party residence, the appraisal should, among other things, show separately for each of these two classes the wire plant connecting them with the central office, the parts of the switchboard consisting of incoming line and the answering jack and other equipment in the central office. It should also show separately the remainder of central office equipment and of such other equipment which is common to both classes.

Apportionment of Different Items of Expense.

As the preceding outline of the distribution of the expenses is very brief and general, a few additional explanations, showing how the different items of the expenses may be apportioned to each class, may be in point. Substation expenses may be so allocated on the basis of the respective number of instruments.

Wire plant expenses require various bases as follows: Maintenance of aerial wires may be so allocated by classes on the respective mileage of aerial wire; maintenance of aerial cable on the basis of the pair feet of conductors; maintenance of pole lines on the cost of the poles in each class

and on the basis of the division of wire or cable carried on the poles for each class of service; maintenance of underground conduit and cable on the pair feet of conductor in underground cable in the service of each class. Central office expenses, including interest and depreciation on portions of the equipment which cannot be assigned at any point to particular classes, are, in the final analysis, a function of the traffic and allocated thereon.

Every call handled through the central office involves two parties; one calling and the other called. Every call takes a certain amount of the operator's time and uses a certain amount of facilities. It also requires that certain other expenses such as operators' schooling, rest and lunch-room expenses, etc., be incurred. It is not fair to assume that the entire cost of handling a message through the central office should be borne by the subscriber calling. This is made particularly evident where flat rate and measured service are found in the same exchange, where the tendency is for the flat rate subscriber to originate the traffic and the measured rate subscriber, except as he uses his telephone for originating traffic up to the amount of his guarantee, to use his telephone as a receiving station.

The result of considering all central office expenses as chargeable to the class calling would be to load the flat rate classes with expenses which normally should be borne by the measured rate classes. A more correct view of the situation is that every message is useful to both parties to the conversation. It would probably be easy to think of individual exceptions to this. There are even cases where certain subscribers find their telephones at once a necessity and a nuisance, with the result that they take what is known as "silent number" service. Taken in its entirety, however, telephone traffic cannot be considered as relating entirely to the party calling.

In apportioning central office expense, such as operators' wages, among the classes of service on the basis of originating and terminating traffic, it is important that consideration be given to the varying amounts of operator's time required for handling different classes of traffic. For example, calls terminating on rural lines requiring code ringing take more of the operator's time than calls terminating on single party business or residence lines. Similarly, calls originating with nickel-in-the-slot service where the operator has to call for the nickel, or with measured service where the operator must depress a key to register the message, require more of operator's time than do messages from lines having unlimited service.

With the incoming and outgoing traffic properly weighted, a percentage analysis can be made, based on a traffic study, to determine the percentage of operator's time required for each class of service and operator's wages and related expenses apportioned on this basis.

Interest, Depreciation and Maintenance Charges.

Further illustrations are in point. For this purpose let us assume that the question is how to apportion the interest, depreciation and maintenance charges on the subscriber's station equipment. When these costs have been allocated by classes they are, as stated, distributed among the users on the message telephone units. These units for the purpose herein may be assumed to be as follows for the residence class:

Residence to residence 1,000 messages; residence to business 800 messages; business to residence 500 messages. The message telephone unit may be described as the use of one telephone in one conversation, consequently 1,000 residence to residence messages would use 2,000 residence message telephone units; 800 residence to business messages would use 800 residence message telephone units and 800 business message telephone units; 500 business to residence messages would use 500 residence message telephone units and 500 business message telephone units. In total, therefore, there would be 3,300 residence message telephone units used. Of these, 2,000 have no relation to the business class. The other 1,300 are used as much for the service of the business class as for the service of the residence class, consequently the final division will be as follows: Residence to residence 2,000 message telephone units charged entirely to the residence class; residence to business 800 message telephone units charged one-half to residence and one-half to business; business to residence 500 message telephone units charged one-half to business and one-half to residence. Of the total interest and depreciation on the residence telephone instruments, therefore, 650/3300 is reapportioned to the business class and the balance charged to the residence.

In dealing with the interest and depreciation on the business telephones the same principle may be applied. This holds true also of other expenses than interest and depreciation relating to the telephone instruments including for practical purposes the entire group of substation expenses.

Wire plant expenses, including interest, depreciation and maintenance and operating costs, are apportioned in accordance with the same principle except that here the unit is a message line rather than a message telephone. For practicable purposes the only difference in results between the message line and the message telephone occurs where subscribers on the same line are talking to each other using two instruments but only one line.

Interest and depreciation upon line and answering jack equipment of the central office is apportioned upon the same basis as wire plant expenses.

What has thus been said may be taken as a general outline of some of the more important features of the methods the commission has sometimes employed in determining the cost per unit of service for rate-making purposes. The experience we have thus had in this work appears to refute the argument often heard that such determinations cannot be made with any fair degree of accuracy; that even if they could be correctly made, the results obtained would be such as to show a lower cost for the business telephones and a higher cost for the residence service; and that for these reasons a rate schedule fixed more closely on costs would be impracticable from a commercial point of view.

Where correct data have been available the analyses made by the commission show unit costs which, if used as bases for rates, would lead to rate schedules that, insofar as the relation of the various classes of rates to each other are concerned, do not differ very much from the more correct and more carefully prepared rate schedules that are now in use. These facts are exceedingly important. They show that the cost basis may be used without causing revolutionary changes in existing methods.

As has thus been pointed out, costs are the most important elements in determining both the fair value of the property and business employed in the service and what constitutes reasonable rates for such service. The importance of costs from these points of view is also certain to increase as time goes on. One reason for this is that cost is, from an economic and social point of view, the best and most equitable basis for these purposes, at least under normal conditions. Another reason is that the nation-wide discussion that has developed of late concerning the justice of charging different rates for different classes of service, will not stop until the soundness of such differential charges has been fully established in the light of economic principles; and the only way in which such differential charges can thus be shown to be sound is through the cost basis.

In view of these facts it is of the utmost importance that the commission and the utilities themselves should do their best in endeavoring to develop sound methods upon which the total cost can be fairly distributed among the different classes of the service and thus become the real basis for rates. Experience also indicates that the cost basis of rate making is not only the most equitable basis for this purpose but that it also, as a rule, results in rate schedules under which the business of the utilities can be best and most easily and fully developed.

Digest of Telephone Articles in Various Publications

Prepared by Arthur Bessey Smith

LONG DISTANCE AND CABLE TELEPHONY, by B. S. Cohen and J. G. Hill. Post Office Electrical Engineers' Journal, Vol. 9, Part 1, April, 1916, pages 1-21; four curves, three tables, one diagram.

This paper was prepared for the International Telephone Engineers' conference which was abandoned because of the war. It is a summary of recent progress made by the British post office in improving telephone transmission.

The distance over which speech can be conducted depends very largely upon the instruments used and the conditions in the rooms used by the correspondents. In England, using as standards the Western Electric common battery set, normal speakers in booths can communicate with each other if the total attenuation does not exceed 5.0. This presupposes the best of accessory conditions. Since the efficiency of the line and the accessory conditions fluctuate considerably, they need to be carefully considered in determining the distance over which speech is possible. Tests have been made which elucidate this subject.

During the winter months a 300-pound unloaded aerial circuit was found to have nearly 10 per cent. variation above and below an average value of 0.0058 for the attenuation constant. This was due to leakance. The mean insulation was about two-thirds of a megohm per mile. The principal wires used for long distance work weigh 400 pounds and 600 pounds per mile. The longest circuits are the London-Glasgow lines, 450 miles long. Their electrical constants are given in the accompanying table.

One means of extending the range of communication is the loading coil. Its practicability depends upon the insulation which can be maintained. Experiments were made to see the effect of loading in all kinds of weather. Extended observations on a 200-mile, 300-pound line showed that in summer weather the loading reduced the attenuation constant 50 per cent., in damp weather 40 per cent. and in very wet weather 30 per cent. Before a line can be loaded, detailed observations of the leakance with alternating current under varying weather conditions must be made.

The range of communication may also be improved by the use of relays. A considerable number of experiments have been made on several types, but the mechanical and the gas discharge types call for special mention. The former is a combination of receiver and transmitter and is capable of augmenting the receiver speech not more than 3. Two methods of securing two-way working have been tried, balancing and switching. The former reduces the amount of augmentation; the latter has not passed the laboratory stage. The use of gas discharge lamps secures approximately the same augmentation; should give better articulation; has no mechanical adjustments, but requires too high a voltage (200 to 240 volts).

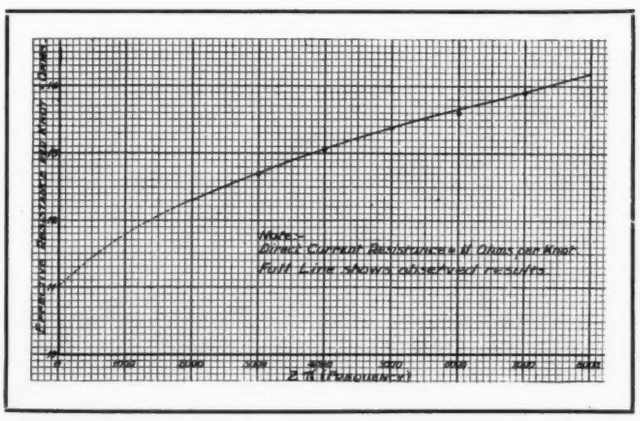


Fig. 4. Variation of Effective Resistance with Frequency.

Unloaded paper cable is not suitable for long distance telephony, but recent improvements in loading coils make it of advantage and interest to compare aerial and underground lines. The least attenuation constant which can be obtained is very nearly

$$\sqrt{KR\left(\frac{R_1}{L_1}+\frac{S}{K}\right)}$$

in which K=capacity of circuit per unit length; R=resistance of circuit per unit length; S=leakance of circuit per unit length; L_1=inductance of loading coil; and R_1=effective resistance of loading coil at 800 cycles per second. This neglects the natural inductance of the circuit.

Weight per mile per wire.	Diameter of wire in mm.	Constants per mile loop.				Attenuation constant.	Characteristic impedance. Zo.
		R. ohms.	L. hys.	S. mhos. *	K. mfs.		
400 lb. copper	4·18 mm.	4·40	0·00344	10^{-6}	0·0092	0·00387	$620·9 \angle 6° 32'$
600 „	4·921 „	2·93	0·00331	10^{-6}	0·0096	0·00279	$591·6 \angle 4° 25'$
800 „	5·683 „	2·20	0·00322	10^{-6}	0·0099	0·00221	$572·8 \angle 3° 19'$

* The mean winter value in England is somewhat greater.

Electrical Constants of Heavy Gauge Telephone Circuits.

For underground work, a coil having a resistance of 35 ohms per henry is available and a value of S/K=20 can be obtained. The best value for an aerial coil is 25 ohms per henry.

Superposed circuits on long overhead lines are not satisfactory in England because of the difficulty of maintaining electrical balance in winter. Underground cables must be carefully made and the pairs joined so as to avoid cross talk, but once right, remain so. The effective capacity of the wires in all combinations is measured in tenth mile sections and suitably selected pairs joined so as to permit the superposition of circuits. At the time of this writing, a loaded and phantomed cable is being laid between London and Birmingham (113 miles) and thence to Liverpool (90 miles farther). It is expected that these circuits will be as efficient as 300-pound aerial line.

Unloaded submarine telephone cable is much less efficient than ordinary underground cable with dry air space. This is due to the use of gutta percha, the value of S/K being of the order of 120 at about 800 cycles per second (paper cables may have 20 or less). On this account makers of submarine cable have experimented to produce a dielectric with better qualities. Siemens Brothers & Co. have succeeded in producing a variety of gutta percha which has a value of S/K not exceeding 20. The British post office has three such cables and a fourth is being made.

Submarine cables can with great advantage be loaded, though we are limited as to the size of the coil, which must not be too large to go into the cable. Even with loading, the range of speech in underground cable is about 1.7 times the range in submarine cable. The capacitance of a phantom circuit in submarine cable is twice that of the physical circuit, which is not the case in underground cable.

Continuously-loaded cable never attains the minimum attenuation constant and the iron winding increases the capacitance and the amount of gutta percha required to insulate the cable. Hence coil-loaded cable appears better from the standpoint of first cost and electrical properties. Regarding maintenance, sufficient time has not elapsed to judge, but the Anglo-

French submarine coil-loaded cable laid in 1910 has not been interrupted.

Some cross talk has been found in the case of superposed circuits, thought to be due to the time required for the sea water fully to surround the conductors. To overcome this, cores are now being made covered with brass tapes. The increase of effective resistance is small.

Experiments made on a single wire submarine cable, 16 nauts long, show the effective resistance of the conductors increasing with the frequency. Fig. 4.

At a frequency a little less than 800 cycles per second (p=5,000), the increase over the resistance for steady current is about 20 per cent.

HOME GROWN TELEGRAPH POLES, by G. Morgan, Post Office Electrical Engineers' Journal, April, 1916, Vol. 9, Part 1, pages 44-60; three tables, two views.

The writer is the controller of the British post office stores department. He calls attention to the necessity for developing native timber and the decrease of interest which has been shown before the war in the culture of the forests. The reason lies in the superiority of the red fir of Scandinavia and Russia; the cultivation of the only suitable trees for the beauty of estates rather than for poles; the low cost of shipping in foreign poles by water; and the lack of sufficient market for rejected home-grown poles.

Although America has not felt the pinch as has England, it is well for us not to let the forests get away from us, but cultivate them expressly for poles.

SECONDARY CELL INSTALLATION FOR TELEGRAPH OFFICES, by J. M. Fernandez Lamothe. Post Office Electrical Engineers' Journal. Vol. 9, Part 1, April, 1916, pages 22-25; two diagrams.

Though this is intended for telegraph men, the idea is good enough to be used by anyone, even a teelphone engineer, when the need arises for it. The idea centers in a switch (Fig. 1) which enables two groups of cells to be charging while others are in service. Six groups of cells are shown, having equal numbers of cells. The switch consists of two insulating discs, concentrically placed. One is fixed and has 12 teeth, connected to the battery poles, also seven rings each connected to one voltage lead as shown. The other disc (movable by

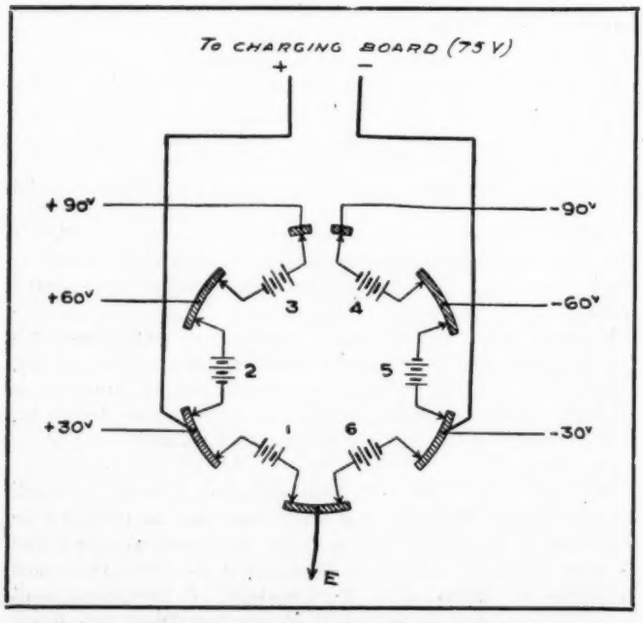


Fig. 1. Connections of Rotary Switch.

steps of one-sixth of a turn) carries 19 contact jaws, engaging the just mentioned teeth and rings.

The action of the switch is understood by imagining the complete set of batteries capable of rotation as a whole. Thus, batteries 1 and 6 can be put into service where 3 and 2 are now, while batteries 5 and 4 are being charged. The use of a three-wire direct current power with grounded neutral is supposed. To secure regular change, the switch is turned once a day. If the supply be 220 volts, the arrangement of Fig. 2 may be employed.

THE BRIDGE MEGGER, by J. B. Salmon, Post Office Electrical

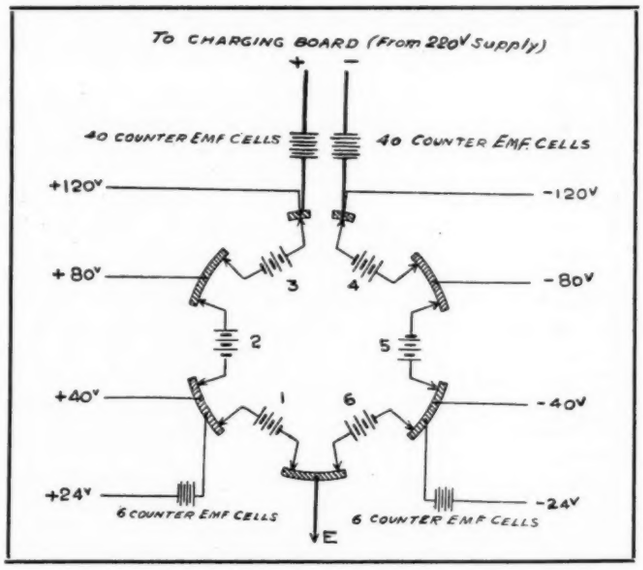


Fig. 2. Rotary Switch with Counter E. M. F. Cells.

Engineers' Journal, April, 1916, Vol. 9, Part 1, pages 32-43; one curve, seven diagrams, nine drawings, one view.

This article describes the bridge megger which is in use quite extensively by the British post office, and because it is sealed, is not very well known as to internal construction. It is a machine which may be used either to measure insulation resistance or lower resistances. It comprises a hand-driven dynamo and a galvanometer built into one. For bridge work, 125 volts pressure is used and 250 volts for insulation tests. A very clear description of the mechanical and electrical structure is given. In all cases the instrument is direct reading, which has proved to be of great value.

Telephones in Hard Coal Mines.

Steady progress is being made in the installation of telephones throughout the anthracite mines of Pennsylvania. There are now instruments in the mines of practically all the large companies at the foot of every shaft, at the head and foot of all main slopes, in the mine hospitals below ground, and wherever there is machinery for pumping or hoisting. Breakage of machinery, fires and accidents can thus be promptly reported. The telephones form a speedy method of communication between the footmen and hoisting engineers in case anything goes wrong with the signal system. Orders are transmitted freely. The installations have proved a valuable adjunct to car dispatching and some of the engineers in charge of this work pronounce it one of the greatest steps in efficiency, and consequently in safety, of recent years.

Credit is due to Chief James E. Roderick of the Pennsylvania Department of Mines who strongly recommended the further extension of mine telephones three years ago. Some of the large companies have the mine telephone systems connected directly with those on the outside, so that, instead of taking the time to come out of the mines or having their messages relayed at the switchboards in the colliery offices, men wishing to report can call up the main office direct. In case of mine fires or accidents, it has happened that a man at the scene of the accident, or within view of the fire has called the main office and secured prompt assistance. This means that the wheels of

the fire or rescue cars can begin to turn within a few minutes after the accident or fire is known. Lives have been saved by the prompt summoning of a first-aid team from the nearest mine hospital.

In addition to the telephone systems permanently installed in the mines, the rescue and fire fighting squads are provided with portable instruments equipped with reels of lighter wire so that the service can be temporarily extended to wherever it is needed. Special insulation is necessary for the permanent wires to protect them from the destructive sulphuric acid present in mine water, and the transmitters and receivers are installed in special boxes protected with paraffine.

There are now thousands of telephones in the mines in constant use. All vagaries of the air currents are promptly reported to the mine foremen. When the presence of gas is detected, or a pocket of it released, that part of the mine can be immediately vacated until the gas is swept away. The effect in reducing loss of life as well as in saving property has been enormous.

The miners no longer work silent and detached, but can communicate promptly with the mine hospitals where first-aid corps are stationed, with all important points in the mines, and with their friends. In fact the telephone in these underground industrial villages corresponds exactly, in its use, with the system in any similar community above ground. If a mine worker felt like calling up San Francisco from the bowels of the earth, there would be nothing to prevent him except possibly the expensive toll.

Proceedings Before Commissions, Courts and Councils

Discussions and Rulings of State Bodies Having Supervision Over Telephone Companies, Decisions of Courts in Matters of Interest to Public Utilities and Actions of City Councils Relative to Franchises, Rates and Service

Board of Public Utilities to Oppose Los Angeles Merger.

Paving the way for interchange of telephone service and ultimate municipal ownership of the two local companies, the Board of Public Utilities of Los Angeles, Cal., has sent the Board of Public Works and a number of business houses circular letters requesting data that will be of assistance in deciding on the best method of installing an interchange service between the Pacific and Home companies.

"We would like to know," says the board, "how many incoming and how many outgoing calls over each system you handle each day."

It is upon this statistical information that the Board of Public Utilities will endeavor to figure out service. And at the same time, according to President Fulton Lane of the board, the data will be used to oppose the proposed merger of the Pacific and Home companies, application for which is now pending before the state railroad commission.

Mr. Lane declares it is not clearly set forth in the merger application that it is intended to effect a physical juncture of properties as well as merely a financial merger of interests. He says if the merger is allowed that it shall provide for an interchangeable service, and that there shall be no obstacle looking to future municipal ownership.

"In this merger fight," said Mr. Lane, "We propose to see that the people's rights are protected. If the merger is consummated we intend that the service be maintained to its highest degree of efficiency.

"We want to be certain it will be a physical as well as a financial merger, which will primarily benefit the stock and bondholders of the Home company.

I understand that if the merger is brought about, the new company will install a measured service. I am in favor of an interchangeable service, and I think the public wants it also. I should like to see such a service provided without effecting a merger of the companies. An interchangeable service would tend to compel the maintenance of a high standard of service.

We have estimated that the joint service would cost about $100,000, with no appreciable difference in present local telephone rates.

The merger application shows that the Pacific company or Bell interests will control the local situation if the request is granted. This contradicts the representation that the Home company would be the controlling power.

The application shows that the Home company is to receive $8,427,000 in bonds for its property, and the Bell company $1,500,000 in bonds and $6,171,500 in stock for its property. This means that in the new company the Bell company will own all the stock and have 100 per cent. control. The American Telephone & Telegraph Co. controls 50.15 per cent. of the common stock and 67.9 per cent. of the preferred stock of the Pacific Telephone & Telegraph Co. and the latter owns 100 per cent. of the Sunset company, the predecessor of the Pacific company."

Hearings on California Telephone Investigation.

In connection with the state-wide investigation by the California Railroad Commission into the practices of and rates charged by the Pacific Telephone & Telegraph Co., a hearing was held at Fresno, Cal., on June 28. Charges of discrimination in suburban rates, failüre to make extension, different charges for extensions in Sacramento and Fresno and general poor service, were made against the Pacific company by attorneys representing the city administration, the civic organizations and local subscribers.

D. A. Cashin and H. E. Barbour, attorneys; H. E. Patterson, secretary of the Merchants' Association; F. M. Hill, manager of the Traffic Association, appeared on behalf of the people, while J. T. Shaw and H. D. Pillsbury represented the telephone company. A. L. Wilson and H. D. Sammis, engineers for the railroad commission, were present and Max Thelen, president of the commission, presided.

Matters of chief interest were the statement made by J. W. Gilkyson, division commercial superintendent of the telephone company, that the company was not making a fair return on its investment as an entirety, and the complaint of subscribers as to service and charges.

On the following day, June 29, the hearing was continued at San Diego. Representatives from Encanto, which recently voted to come into the city, petitioned that that district be given local service and rates, and that the present ten-party lines be supplanted by two and four-party lines. Manager J. E. Franklin, of the local company, was questioned at length on the San Diego telephone situation.

Nebraska Supreme Court on Jurisdiction of Commission.

The Supreme Court of Nebraska has ruled that state control of telephone companies, both in regard to rates and service, cannot be supplanted by municipal control, unless there be special enactment by a legislature authoriz-

ing such municipal control. The decision was made in the Polk county case, which for two years has been a bone of contention in telephone circles in Nebraska, so far as "state or municipal control" is concerned.

The Nebraska State Railway Commission for more than two years has held officially that the rate of $2.50 per month for business telephones in the city of Stromsburg, Polk county, has not been too high, while the city council of Stromsburg has sought to reduce the rate.

The question of conflict of authority between the Stromsburg city council and the Nebraska State Railway Commission, was taken to the supreme court of the state. In its ruling, the high court of the state made the following observations:

"Unless expressly empowered and authorized by the legislature so to do, a municipal corporation has no power by contract to deprive the state of the right of regulation of rates of a public service corporation.

A contract or agreement made in a franchise ordinance by which the maximum rates to be charged by a telephone company for the use of telephones by the inhabitants of the city, is made subject to the right of regulation.

Since the adoption of the constitutional amendment creating the state railway commission and the passage of the law specifying the duties of said commission, that body has power to regulate the rates charged for the use of telephones in cities of the second class.

The statute provides that in appeals from the decision of the railway commission in the matter of rates or charges, such a decision is prima facie evidence that the rates fixed are just and reasonable, and such rates shall remain until annulled, modified, or revised by the commission, or until finally adjudged to be unreasonable and unjust in a court of competent jurisdiction. (Sections 6,127 and 6,139 Revised Statutes.)

Evidence examined and held that the rate of $2.50 per month allowed by the commission to be charged for the use of telephones for business purposes in the city of Stromsburg, has not been shown to be unreasonable and unjust."

Thus the Nebraska Supreme Court holds that the state constitution and statutes in Nebraska, take away from municipalities, all power of telephone rate regulation.

Rate Reduction Effective in Milwaukee, Wis.

The 10 per cent. reduction in the rates of the Wisconsin Telephone Co. in Milwaukee, ordered by the Wisconsin Railroad Commission on April 19, became effective Saturday, July 1. The classes of service affected are: One party unlimited business service, one party measured business service, one, two and four party nickel business service, one party measured residence service, two, four party unlimited residence service, and one, two and four party nickel service.

No changes were made in the two party business, the one and four party limited residence, the private branch exchange, pay station, or rural rates.

Final Settlement of Utah Toll Rate Controversy.

Officials of the united commercial clubs of Salt Lake county, Utah, and of the Mountain States Telephone & Telegraph Co. have announced a final settlement of the controversy over toll rates in the southern part of the county. The schedule of rates agreed upon after several months' negotiation between the clubs' committee and officials of the telephone company, has been ratified by the last of the commercial clubs and the telephone company will now proceed with the rebuilding of the Murray and Midvale exchanges. The new schedule will not be effective until these improvements have been made. The schedule offers both toll and flat rates to subscribers on the Murray and Midvale exchanges and contains reductions in the present charges for flat rate service.

Injury to Lineman in Setting Poles.

Where a telegraph lineman requested the foreman to furnish a "deadman" for use in erecting poles, and the foreman assured him that its use was not necessary, the lineman did not assume the risk occasioned by the failure to furnish the "deadman." Where the evidence was conflicting as to whether the use of a "deadman" was necessary for the safety of telegraph linemen erecting poles, and whether the injured employe requested its use, but was assured by the foreman that it was not necessary, the determination of those issues by the injury in favor of plaintiff is final. Coal & Coke Railway Co. vs. Deal; United States Circuit Court of Appeals; 231 Federal, 604.

Ejectment From Telephone Booth.

In an action for assault and battery, committed by defendant's general manager after he had rightfully ejected plaintiff from defendant's telephone booth, using no more force than necessary, evidence was held sufficient to take to the jury the question whether the subsequent assault, following almost immediately thereafter, was a continuance of the first assault, so as to render the defendant liable, or was a mere personal quarrel, having no relation to the duties of the general manager. Whitted vs. Southwestern Telegraph & Telephone Co.; United States Circuit Court of Appeals; 231 Federal, 926.

Telephone Tolls Not Included in Mortgage Foreclosure.

A receiver, under foreclosure of a mortgage on an apartment house, authorized to collect "rents, issues, and profits" thereof, has no right as against the mortgagor to telephone tolls collected from tenants for messages sent through the exchange in the building, since the money was earned, not from the property, but from contract with the telephone company. Fifty-Ninth Street Real Estate Co. vs. Murphy; Supreme Court of New York; 159 New York Supplement, 203.

Liability for Death of Lineman.

The doctrine of duty of master to furnish safe places has no application in the case of a lineman on a pole killed by contact with a high-power wire, if he was not assured that the current was cut off, the place being, as he well knew, naturally and intrinsically dangerous if the current was not cut off. A lineman who ascended a pole, without direction so to do or assurance that it was safe, and was killed by contact with a high-power wire, assumed the risk. Koch's Admx. vs. Louisville Gas & Electric Co.; Court of Appeals of Kentucky; 185 Southwestern, 817.

Shriners' Train Equipped With Automatic Telephones.

Osman Temple of St. Paul, Minn., on its pilgrimage to the Forty-second Imperial Council session of the Shriners at Buffalo over the Burlington, was equipped with a complete automatic telephone system installed and operated by the Tri-State Telephone & Telegraph Co., of St. Paul. This is said to be the first instance of an entire train being equipped with an automatic system.

Delay in Making Repairs Not Discrimination in Service.

Kirby's Digest, section 7,948, imposes a penalty on a telephone company for discriminating against a patron. A showing was made that after its wires were disconnected by the burning of its cable, the company immediately started to renew the cable and restore the service; that a test to plaintiff's residence showed the connection; that it was again fixed a few days later, though

not finally repaired until a week more, as soon as the defect could be located. As no showing was made of any intent to discriminate against, or refuse telephone connection to the plaintiff, the court held that it at most showed mere negligence, not entitling the plaintiff to the penalty. Southwestern Telegraph & Telephone Co. vs. Fendley, Supreme Court of Arkansas, 184 Southwestern, 424.

Summary of State Commission Hearings and Rulings.

CALIFORNIA.

July: The commission denied C. F. Nickel, manager of the Hughson (Cal.) Telephone Co. the right to close his exchange. The controversy began when the commission ordered the restoration of service to four patrons whom Manager Nickel had disconnected on account of a dispute over the rates they were to pay. Upon receiving this order from the commission, Manager Nickel immediately sent out notices to his 200 patrons stating that service would be discontinued at midnight of the following day. Upon being notified of Manager Nickel's proposed action, the railroad commission got in touch with him by telephone and ordered him to continue the operation of the exchange. A hearing will be held in the near future for a settlement of the difficulties between the patrons and Manager Nickel.

COLORADO.

July 12: Continued hearing on the investigation into the reasonableness of the rates and adequacy of the service of the Mountain States Telephone & Telegraph Co. in the state of Colorado.

ILLINOIS.

July 6: Complaint filed by Myer T. Stein, of Oak Park, Ill., asserting that the Chicago Telephone Co. compels him and other subscribers in Oak Park to pay unreasonable charges compared to rates in other localities for like service and asks that the commission fix a reasonable charge which will prohibit discrimination.

July 6: Farmington (Ill.) Telephone Co. ordered to accept toll messages from the Galesburg Union Telephone Co. It is found that the two companies have been using a common line to Middle Grove and that this constitutes a physical connection.

July 6: Joint agreement for the sale of one-half interest in the Ozark Telephone Co., by Otto E. Stout, to the Murphysboro Telephone Co., approved.

July 6: Joint agreement for the sale of the Chatsworth Telephone Co. (unincorporated) to the Chatsworth Telephone Exchange (incorporated), approved. The price paid is $19,000 and it is stipulated that the consolidated concern cannot be capitalized at more than $16,000 and that the terms of the order must be accepted within 30 days. A certificate of convenience and necessity also was issued to the Chatsworth Telephone Exchange.

July 11: Hearing in the matter of the application of the Interstate Independent Telephone & Telegraph Co. for an order ratifying its action in issuing certain notes aggregating $47,683. Case 5,083.

KANSAS.

June: Application filed by the Anthony & Northern Railroad asking that the Missouri & Kansas Telephone Co. be forced to raise its telephone wires at Belpre, Kan., so that the new railroad can string its telephone and telegraph wires.

July 6: Application filed by the Peoples Home Telephone Co., of Leavenworth, Kan., for permission to make an increase of 50 cents in its two-party business, single line residence and two-party residence rates.

September 12: Postponed hearing on application of the Missouri & Kansas Telephone Co. for permission to increase its rates at Wellington, Kan.

MICHIGAN.

July 6: Postponed hearing on the application of the Michigan State Telephone Co. for permission to establish a metered service schedule of rates in Detroit.

MISSOURI.

July 10: Hearing in Jefferson City, Mo., relative to the valuation of the plant of the Central Missouri Telephone Co., at Fulton, Mo. Case 852.

September 18: Hearing in the matter of adopting a uniform system of accounts for telephone companies. Every telephone company in the state has been given notice that it will be expected to be present or to be represented, and to introduce any evidence necessary to assist in the promulgating of a uniform system of accounts for telephone companies. Case 937.

September 18: General conference in which representatives of all telephone companies in the state are to meet with the commission and to introduce all testimony and evidence required in the adoption of uniform rules, regulations and practices for telephone companies, relative to all charges, deposits, contracts or guarantees for all kinds of service and connections. Case 938.

OHIO.

July 6: The commission denied the joint petition of the Citizens Telephone Co., of Circleville, Ohio, and the Home Telephone Co., of Chillicothe, Ohio, for an order to sell certain telephone lines and fixtures belonging to the Citizens company, and dismissed the application. Order 785.

WISCONSIN.

July 5: The Badger Telegraph & Telephone Co. reduced duced its rate for toll service between Juda and Brodhead its rate for toll service between Juda and Brodhead from ten cents for three minutes to five cents for two minutes.

July 6: The commission disposed of the application of the Equity Telephone Co., of Cushing, Wis., for authority to increase rates, by granting a part of the request. It was desired to increase the present rate of $1 per month to $1.25. According to the data available it appears that on December 31, 1915, the company had 344 patrons. The cost of the plant at that time as reported by the company was $13,231. Revenues for the year were reported at $4,930 and expenses, exclusive of depreciation and interest, were $4,290. The commission found that the expenses of the plant, exclusive of interest and depreciation, were $3,556. The commission refused the full application because the lines of the company are heavily loaded, but approved the following rates: Single party telephone, $1.25 per month; telephones on party lines, $1.10 per month.

July 6: The commission approved of applications for telephone extensions in the following territory:

Elroy (Wis.) Telephone Co. Extension in Glendale allowed.

Busy Farmers Telephone Co., of Monticello. Proposed extension in Albany and Mt. Pleasant allowed.

Wisconsin Telephone Co. Proposed extension in Trenton allowed.

Washington Central Telephone Co. Proposed extensions in Washington allowed.

July 6: The commission directed its engineering department to make an immediate valuation of the property of the La Cross Interurban Telephone Co., at Viola and Reedstown, Wis.

July 7: The Amery Electric Co., of Amery, filed an agreement with the Deronda & Dwight Telephone Co. and the Little Falls Rural Telephone Co. whereby the latter pay a switching charge of 35 cents per month.

July 11: The Farmers' Mutual Telephone Association, Pardeeville, filed a non-stockholders' rate of $1 per month.

July 11: The Tri-State Telephone & Telegraph Co. filed a schedule of joint toll rates between it and the Northern Wisconsin Toll Line Co.

July 11: The Wisconsin Telephone Co. discontinued its toll station at Bethel, Wis., because the line connecting that station with the main line has been sold to the Auburndale Telephone Co.

July 10: The commission approved the following applications for extensions:

Wisconsin Telephone Co., in the town of Trenton, Dodge county.

Washington Central Telephone Co., in the town of Washington, Eau Claire county.

Elroy Telephone Co., in the town of Glendale, Monroe county.

Random Lake Telephone Co., in the towns of Belgium, Ozaukee county, and Holland, Sheboygan county.

Cecil Green Valley Toll line Co., in the town of Washington, Shawano county.

Horseshoe Telephone Co., in the towns of Carlton and West Kewaunee, Kewaunee county.

July 11: A new schedule of rates was approved by the commission for the Eastern Wisconsin Telephone Co. at its New Holstein exchange. The company at present does not give continuous service but proposes to do so if the increase of 25 cents a month is allowed. Operating revenues for the year 1915 were $2,367 and operating expenses, including depreciation and taxes, $2,026. On the finding that the giving of continuous service will increase the operating expenses of the company enough to justify the proposed increase in rates, the company allowed the new schedule.

July 11: The application for an increase of rates made by the Necedah Telephone Co. was also granted. The present rates are 75 cents a month for residence telephones and $1.50 for business telephones. An increase of 25 cents a month was asked. The commission says: "Although it is true that the property at present is not in very good condition, it seems that it will be impossible to get it into shape and keep it in satisfactory working order unless some increase in rates is authorized. We are therefore of the opinion that the application should be granted."

Hitches, Knots, Loops and Ties for Telephone Plant Men

What Practice Shows Is Best for Rope and Rigging Work in Telephone Construction—Qualifications Which Knots or Ties Must Fulfill in Everyday Practical Work—Descriptions of Various Knots and Ties—Reproduced from The Telephone News

By D. S. Hilborn and C. L. Brown

Among the many stories that have come down to us from Ancient Greece, none is more interesting than that of Gordius, who tied a knot so intricate that it was foretold that he who could undo it would become master of the earth. The puzzle remained unsolved until Alexander the Great severed the knot with his sword. As we all know, he became the ruler of the then known world.

This knot evidently answered its purpose, but it would never do to use such an intricate tie for rope and rigging work in telephone construction. For joining ropes to each other, or attaching them to various objects to be held, hauled or lifted, knots or ties must fulfill, in every-day practical work, three qualifications, viz.:

1. They must have a strength at least equal to the rope.
2. They must not jam—must be easily undone.
3. They must not injure the rope.

Many other types and kinds of bends, ties and hitches—some useful, some purely ornamental—besides those shown here are known and used, principally aboard ship.

Before describing those loops, knots or ties most frequently used, the definition of certain technical terms, which are applied in explaining them, is in order.

"BIGHT": A section of rope turned back on itself to form a loop, Figs. 1 and 2.

"CUCOLD'S NECK": A second bight turned above the first as in making a bow-line knot, Fig. 11, *A*.

"LOOP" OR "TURN": A rope passed once around a pole and the ends brought together.

"ROUND TURN": A rope passed twice around a pole and the ends brought together, Fig. 23.

"STANDING PART": The section of rope leading away, which the round turn or hitch is made to hold; the part which takes the strain, as in Figs. 12, 20, 22 and 24.

TYING ROPE ENDS TOGETHER.

FLAT KNOT: The most common knot in use for tying together the ends of two ropes or cords is the flat knot. Fig. 3 shows the knot before pulling tight, and clearly indicates its make-up. Fig. 4 shows the finished knot. While this knot is safe and excellent for ordinary use, it will jam under a strain, so that it cannot readily be undone.

FLAT KNOT OVER A PLUG: When it is desirable to use the knot just described, jamming under a heavy strain can be prevented by making the knot over a tapered wood plug, Figs. 5 and 6. When the strain is released and the plug driven out, the knot is easily undone. A second tie over the plug is a good "Safety First" precaution.

GRANNY KNOT: This knot results from the failure to tie a flat knot properly. It should never be used, but is shown in Fig. 7 so that this incorrect way of making a flat knot may be avoided.

WEAVER'S HITCH OR KNOT: Through the loop of a bight turned in the end of one rope, pass the end of the other rope. Then take a half hitch (first paragraph under Hitches) with the latter about both parts of the bight, Fig. 8.

If one of the two ropes to be joined is smaller than the other, the bight should be turned in the large rope, the small rope passed through the loop and two or more turns taken in the half hitch. Fig. 9 shows this knot with two turns in the half hitch. This tie is preferable to the flat knot, as it will not jam and can easily be undone by pushing back the loop of the bight.

LINKED BOW-LINE KNOTS: A safe connection between two ropes, which will not jam under strain, is obtained by making a bow-line knot (Fig. 12) in the end of one rope, passing the end of the other rope through this loop and tying it in the same way (Fig. 10). One or both knots may be run out to take up any surplus rope. This method is especially adapted for use with heavy ropes.

LOOPS, EYES OR SLINGS.

BOW-LINE KNOTS: For forming a temporary loop or eye at the end of a rope or in a bight at any point on a rope, the bow-line knot is the best. There are three forms of bow-line knots, and if the workmen are taught only these forms, they will more quickly become proficient in making safe loops which will not slip, jam or injure the ropes and which can easily be united.

SINGLE LOOP BOW-LINE KNOT: Take the end of the rope in the right hand and form a long bight by laying the end across the standing part, Fig. 2. Then with the left hand turn a cucold's neck (Fig. 11, *A*) over the end. Lead the end around the standing part and back through the cucold's neck and pull tight, Fig. 12.

SINGLE LOOP BOW-LINE KNOT ON A BIGHT: Using a bight instead of an end, lay the bight across the standing part and turn a cucold's neck over it, Fig. 13. Lead the loop of the bight around the standing part and back through the cucold's neck and pull tight, Fig. 14. The idle standing part may be used as a snub to hold the strain taken up by the loop.

SAFETY SLING: This is a modification of the knot described in Fig. 15 and 16, and is of great use where it becomes necessary to send a man aloft to remove a helpless man or for similar emergency purposes.

Make a double loop bow-line knot on a bight, but before pulling tight slip the loop of one of the large bights through the knot, thus forming one large and one small loop—the former to sit in and the latter to pass around the body under the arms, Figs. 17 and 18.

In case of emergency, where it is necessary to send a man aloft—e. g., to remove a helpless man from a pole—a knowledge of how to make this sling quickly will be found useful.

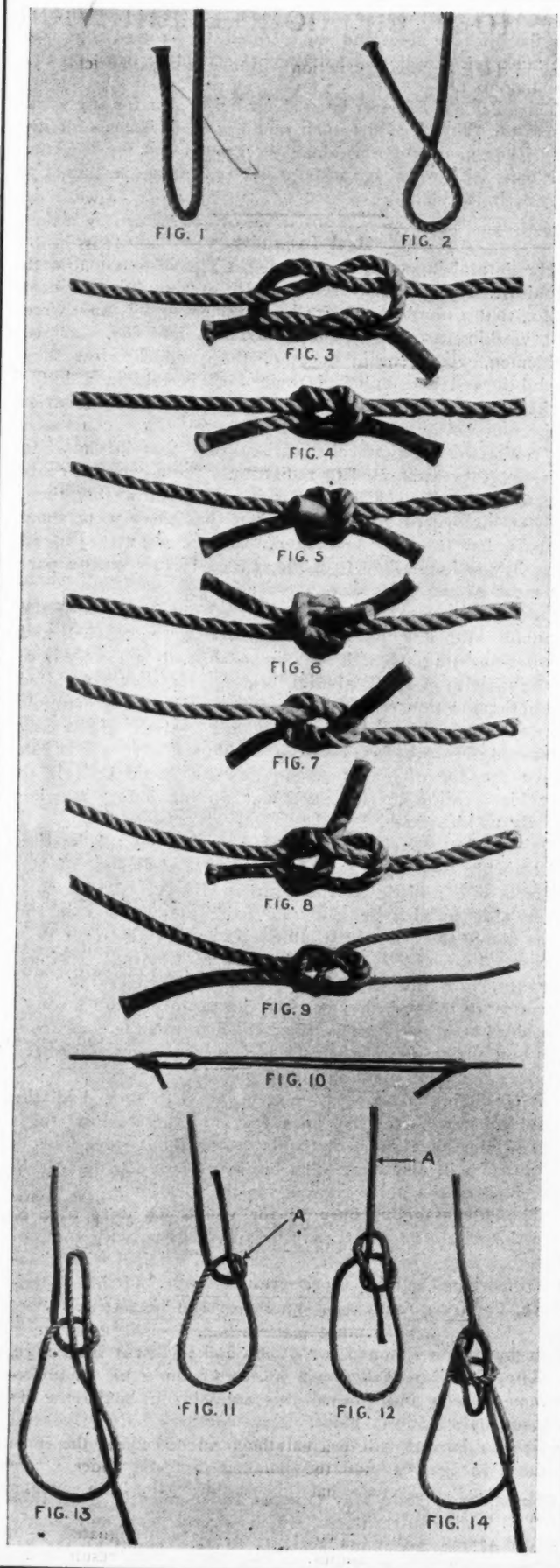
DOUBLE LOOP BOW-LINE KNOT ON A BIGHT: Using a bight of rope, as before, lay it across the two standing parts and turn a cucold's neck in both parts over the bight, Fig. 15. This forms two large bights below and one small bight above the cucold's neck. Loop the small bight over the two large bights and pull tight, Fig. 16. One or both standing parts may be used against the double loop, but not in different directions, as with the single loop bow-line knot on a bight.

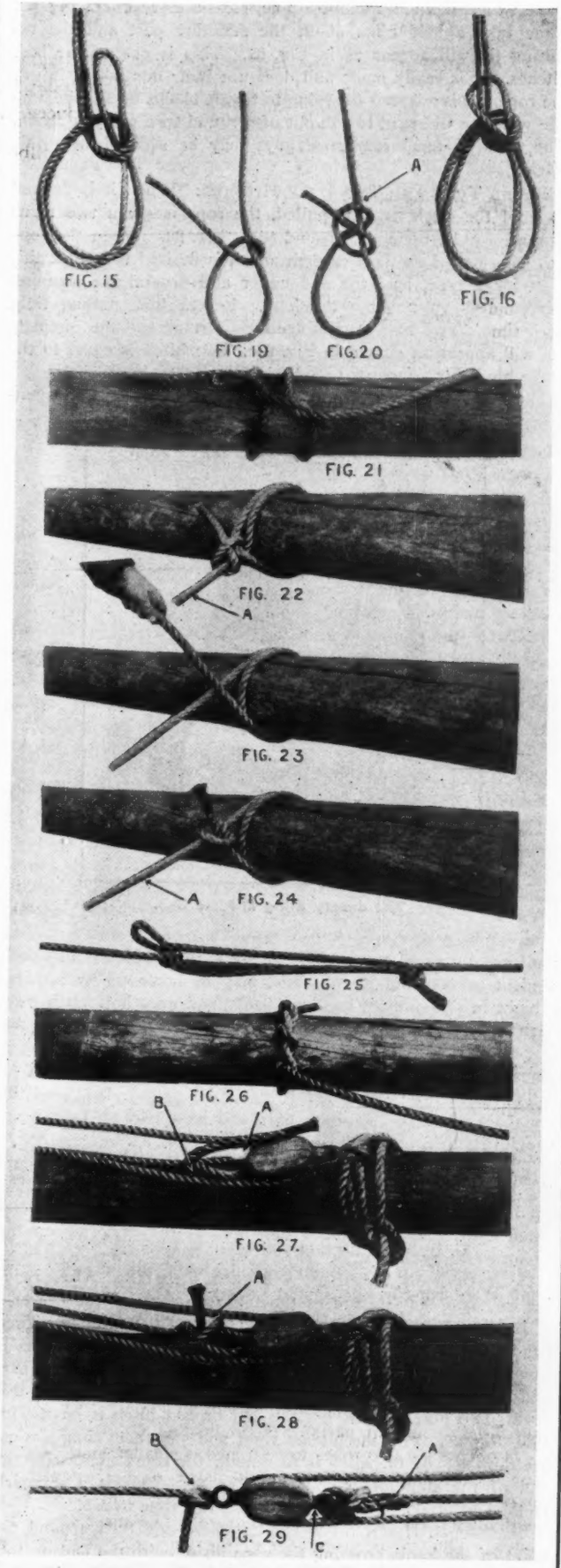
HITCHES.

HALF HITCH: To make this hitch, bend the end of the rope up and across the standing part, forming a bight. Lead the end around the standing part and through the bight, Fig. 19. A half hitch in itself does not form a complete tie, but in conjunction with other forms of securing rope it is the one most generally used.

CLOVE HITCH: Form a half hitch and then lead the end of the rope again around the standing part and under its own loop, Fig. 20. The two half hitches thus formed are commonly known as a clove hitch.

In general practice two half hitches are designated in this way. However, an additional half hitch would result in a tie which would be called three half hitches.



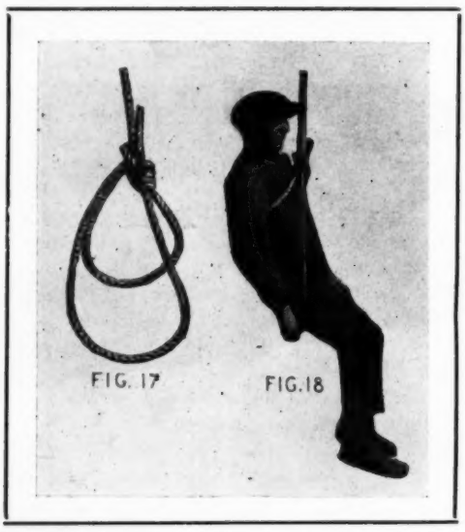


How Ropes Should be Tied, Loops, Eyes or Slings Made and Hitches Formed for Use in Telephone Construction Work.

CLOVE HITCH WITH A HALF HITCH ON THE STANDING PART: Take two half hitches about a pole, etc.—a clove hitch, Fig. 21. Then take a half hitch about the standing part and the resulting tie will appear as in Fig. 22. This is one of the best hitches. It is easily made and does not jam; nor will it injure the rope. It is adapted for tying to toggle blocks or any anchorage which would tend to roll out of a round turn under a strain. The ends of temporary rope guys may be secured with this hitch.

ROUND TURN AND TWO HALF HITCHES: When it is desired to hold the slack as it is pulled, the rope is given two turns around a pole, forming a round turn, Fig. 23. When the rope has been pulled up tight enough and it is desired to hold it this way for a time, lead the end under and around the standing part and down through the loop. Repeat this, pulling tight each time. Two half hitches are thus formed and the complete tie will appear as shown in Fig. 24. This hitch is equal to the clove hitch for attaching to any rigid support.

HALF HITCH ON THE BIGHT OF A ROPE: In laying out a pennant or guy rope, any surplus or slack rope which it is inconvenient to take out at the ends, may be taken up by bending a bight in a section of the rope and throwing a half hitch over each end of it, Fig. 25. Although, if properly made, this hitch is perfectly safe, it is well to have those not familiar with it place two half hitches on each end.



The Safety Sling and Its Use.

TIMBER HITCH: Take a turn around a pole or log, bend the end back over the standing part and pass two to four turns around its own part. Then slip up tight, Fig. 26.

This hitch is used principally in logging on the water, where the heavy wet ropes are difficult to secure. It should not be used for snaking poles on the ground, except in emergencies when a log chain cannot be obtained, as the dragging on the ground destroys the rope.

INVERTED HALF HITCH ON A BECKET THIMBLE: After reaving off, pass the idle end of the fall rope through the becket—*A* in Fig. 27 and *C* in Fig. 29—and around the thimble. Then bend it about the standing part—*B* in Fig. 27—and over itself towards the thimble. Bend it again around the standing part and through the loop thus formed. It will be seen that this forms two half hitches, but the end or last hitch is on the inside, Fig. 28. Pull the hitches tight and slip them snug against the thimble. If the hitch is to remain for some time, seize the end of the standing part—*A* in Fig. 29. This is a standard method of attaching the idle end of a fall rope to a block.

BLACKWALL HITCH ON A HOOK: Give one turn around the point of the hook, crossing the rope inside with the end on top. Slide the loop around to the back of the hook. This will bring the end beneath, where it will be held by the pressure of the standing part on it—*B* in Fig. 29. This hitch should not be made with a small rope in a large hook, as there would be room for the hitch to upset and slip. Unless the crossed rope fills the hook fairly well, two half hitches should be taken on the standing part.

This hitch should never be used for hoisting or for any work where the slipping of the hitch would result in damage or injury. For hauling a rope along the ground and the like, the quickness with which it can be made and undone, makes it a very desirable method.

Real Ingenuity.

Here's real ingenuity for you, says The Mountain States Monitor. It was discovered recently at Colorado Springs, Colo., that a number of pairs in an underground cable were not working as they should. Mr. Lea and Mr. Garrett, cablemen, were sent in quest of the trouble. How they found it and accomplished their duty is told in a letter written to Division Plant Superintendent Pierce by District Wire Chief Ayersman, and follows:

"While the division construction force was in Colorado Springs, they attempted to redistribute the 5 cycle of cable 26, which cycle had been working light until this time. It was discovered while testing out that there were some 15 pairs bad in the underground. In checking up we found that it was impossible to make our cable cuts until a part or most of the pairs were cleared.

Mr. Lea, our cableman, was started out in quest of the trouble, but, due to the pairs that were crossed and grounded being open, it was impossible to get a definite location with the Wheatstone bridge. He then attempted to get a location of the section by testing from manhole to manhole with the wireless cable tester. He finally obtained this location between manholes 3,789 and 3,995. Then the difficulty arose as to how he would be able to get his location in this particular section before starting to dig up the earth.

It was first considered advisable to pull out this section of 300-pair 19-gauge cable, but with the assistance of Mr. Garrett and a little ingenuity, they discovered that they were able to pick up the tone from the wireless in the duct above the cable in trouble. After this discovery they borrowed sewer rods from the city of Colorado Springs. By attaching the exploring coil of the wireless test set securely to the rod, they worked the exploring coil through the duct to a point where they failed to get the tone from the box, which point, when the rods were measured, showed 79 feet north of manhole number 3,995.

After being thoroughly convinced that they had the trouble located, they dug up and opened the conduit, which disclosed a blowout in the cable armor about three-fourths of an inch in diameter. The blowout proved to be within one inch of the point marked for the location.

The advantageous purpose for which we were able to use the wireless test set may be an old game with some of the districts. However, it was new and original with Colorado Springs, and for those who have not had this experience, the foregoing may be more or less beneficial."

Improvements Planned for Storm Lake (Iowa) Exchange.

The Northern Telephone Co. is planning to spend between $40,000 and $50,000 this summer in improving its Storm Lake (Iowa) plant. New common battery central office equipment will be installed and all wires placed in cables.

Companies in Italy May Operate Independently Until 1923.

The Italian government, which several years ago bought most of the telephone systems of that country, has extended until 1923 the time in which some smaller companies may operate independently.

The Relation of Plant Design to Service and Rates

Design of Plant and Maintenance During Operation of Prime Importance in the Furnishing of Good Service and Subsequently in Demanding a Fair Rate in Return—Paper Presented at Convention of Canadian Independent Telephone Association

By W. J. Herdman

An operating telephone company is a business concern and its business is to sell service—nothing more. Like all other selling organizations it can command a profit-making return on the sale of its commodity if that commodity measured by accepted standards is good. If the service is good the public, acting according to its general custom, pays an adequate rate without grumbling. If the service is poor, the public objects to paying even a low rate.

A rate is good in merely a relative sense. However, the rate charged by one system bears no relation to the rate of another system. A rate that nets one company a fair return on its investment will be considered by that company a good rate, yet that same rate might not net another company of similar extent any return at all and would, by that company, be considered a poor rate.

If a man were starting, say a department store, or mail order business, with which to make a fortune, the services of a bundle wrapper would not be sought for enlightenment upon how to select the stock, the extent of stock in several lines, organization, etc. No indeed, he would quite likely seek the services of experienced men, each with special training in the various lines upon which information is wanted. In other words, he would try to organize the business so that a net profit could be obtained without being forced to charge excessive prices for the goods.

Similarly one cannot take a telephone system, the original design of which is bad and which is poorly maintained, and expect with rates that the public will consider reasonable, to make a success of the business, because a grade of service that will reconcile the public to the high rate such a system would require to succeed, cannot be given. The day the telephone systems were designed, constructed and maintained in a hit-or-miss style, and the service in consequence likewise of a hit-or-miss character, has passed, as the public has been educated to have a standard by which to measure the service for which it pays.

Upon What Good Service Depends.

Good service depends, among a number of things which are widely variant extending from electromechanical features to the psychology of the operating force, upon the original design of the plant and its maintenance during operation. Now, as the need of maintenance is itself largely dependent upon the original design of plant, it is obvious that the design of the plant is of prime importance to the giving of good service.

A properly designed plant is, in general terms, one that will adequately serve all the present subscribers without undue maintenance cost and which has inherent in its design, facilities for absorbing additional subscribers with minimum expense.

The design of telephone plants is in itself a business. It requires an enormous amount of experience in widely variant lines as well as insight into the future, for a telephone plant is built not only for the present, but for the future. Its design should plan to meet the needs of an increasing population, an increase in telephonic development, movements of populations in cities, changes in character of population of cities, shift of business and residence centers and areas, etc., so that future business may be taken care of with small cost of plant addition, and that expensive equipment is not originally installed, the use of which is too remotely deferred.

Perhaps it might be well to mention here a few of the most salient design features of rural magneto systems.

Design of Plant with Reference to Wire Mileage.

In the first place, the design should be made from a map of the territory upon which are accurately located all of the known subscribers as well as all prospective subscribers. The design should seek to reach all the subscribers with minimum wire mileage and yet to so locate the lines that the prospective subscribers may be added to the system with minimum expense in regard to new construction.

The number of parties on party lines should be determined and fixed. This number in the design should not be exceeded unless the design, as it progresses, shows that the wire mileage necessary for extra party lines is out of proportion to the consequent gain in service through keeping down the number of parties on one line to the predetermined limit. It is well to so locate party lines as to include on one line subscribers who are to each other immediate neighbors.

The central exchange should fundamentally be located as nearly as possible in the center of the telephonic development in order that the wire mileage per subscriber shall be as low as possible. But so many other factors enter into the location of the central, such as the sentiment of the people, marketing center, communicating roads, character of the surrounding industries, politics, etc., that the location of the central office should in every case be very carefully studied.

The main lead should always, if possible, be located on a road that is well traveled and one that remains open in the winter time. Further, this roadway should be free from trees or the trees should be kept well trimmed. Heavy leads of open wire should not be permitted in the design. Cable better serves the purpose and the extra cost is offset through the decrease in maintenance costs.

The wire plant should be designed to feed away from the central office and never to feed back. The cross arm leads should be designed with sufficient pin space to care for all needs in a ten-year period. The cable plant should be designed to permit of easy access for test purposes to each section of cable. Protected can tops should not be too freely used as they are, through grounded carbons, a cause of poor service. The size of the cable in the entire cable plant should always be in excess of the present needs, the amount of excess being governed by the prospective subscribers.

The switchboard, interior cabling, cross connecting and protective frame should, of course, be designed to accommodate the future growth of the enterprise.

Effect of Poor Design Upon Service.

As an example of how poor design affects the service and consequently the rates of a telephone system, a case that came under the author's observation some years ago might be mentioned. In this case a company was peti-

tioning for an increase of rates. It claimed in its petition that the existing rates did not meet the expenditures.

An examination of the plant disclosed, among a number of poorly designed features, the fact that the underground plant as originally constructed, had a great many trench feet of six-duct conduit extending say westwardly from the central office and several thousand trench feet containing two-duct conduit extending in the opposite direction from the central office. In five years after the plant had been constructed, the two-duct conduit had been dug up three times. It finally consisted of six-duct conduit, each duct full of cable. In that same time, the westwardly extending conduit originally with six ducts had but one 100-pair cable therein.

In this example of poor design, the designer accurately estimated the future growth but guessed entirely wrong as to the direction of that growth. It can readily be seen that a great deal of money was expended in plant additions which would otherwise have been saved for maintenance or dividends, and the need for a petition for increase of rates would have been unnecessary.

Other examples of a similar nature might be cited, but that one will serve to illustrate how poor design diverts cash from maintenance to plant addition to the detriment of the service, without mentioning delay and interference to the service during new construction.

In the bringing of a plant design into being through construction it may only be said that here quality in workmanship and supplies should never be sacrificed for cheapness. as poor workmanship and poor material are ultimately paid for out of the maintenance money chest.

Experience extending over years in telephone construction has finally resulted in producing a series of practices which are known as standard. These practices are exemplified in what are known as standard specifications. Every telephone plant, no matter how small, should be constructed in accordance with these standard specifications, both as regards material and workmanship. A poorly constructed telephone plant requires the maximum amount of maintenance and can never give high grade service. Consequently a poorly constructed telephone plant cannot expect to command for its service a high rate.

Definition of Maintenance Expense.

Maintenance expense is the cost of keeping a telephone property as nearly new as is possible without reconstruction or replacement. It may be termed "current repair." When a property has been maintained or kept in a state of repair for a certain length of time, its condition becomes such that economy requires making over or putting something else in its place. These acts are, respectively, reconstruction and replacement—neither can be correctly termed maintenance or current repair.

The hazards which time brings to bear upon telephone properties are primarily those of decay, wear, and adjustment. Good design and good construction limit these actions. Good maintenance practice repairs damage caused by decay, repairs parts made inefficient by wear and restores adjustment. The quality of telephone service is intimately connected with maintenance methods and maintenance cost. When an element is repaired, it should be repaired to stay so and with as short a service interruption as possible.

The fundamental rules of good maintenance are thoroughness and promptness. One cannot leave a case of trouble on an outlying telephone until several cases are reported from the same district, in order to save expense by making several repairs on one trip, and expect to give service for which a subscriber will be satisfied to pay.

A telephone system, if too large in extent to be promptly covered by one troubleman, should have upon its pay roll as many troublemen as are necessary to promptly and efficiently repair all troubles. In fact, the telephone business, as with any business, requires certain necessary attendants, and the number of these attendants is a definite ratio to the size of the plant. One cannot expect to skimp on attendants and give good service, unless the effectiveness of the attendants in increased through employing motorcycles or automobiles for their use in covering the plant. This procedure has become a recognized method in many telephone companies for service betterment.

The maintenance men should hold definite positions with the telephone company. This applies even though the plant is so small that only one man is required. Even if his services are not actually being used in repair, he may be patrolling the plant to anticipate troubles by prevention, for in maintenance as in medicine, an ounce of prevention is worth a pound of cure.

In a purely general way the effort has been made to show how plant design and maintenance are linked with service and rates. In conclusion, it is desired to bring out the fact that telephone systems, the designs of which are faulty, may offset this largely by high grade maintenance. The problem under these circumstances is then to render effective every cent spent in maintenance by employing systematic methods, time-saving methods, proper organization, etc., that the service may be maintained at high grade with reasonable expense in spite of faulty design, for the public will pay a good rate and the powers that be will allow proportionately higher rates for good service.

Putting the Telephone to Work.

Undoubtedly there are some things that can't be sold by telephone, but they are not easy to find, says The Telephone Review. Often the business in which the telephone seems least useful is found elsewhere to be conducted almost exclusively by wire. One merchant may insist that his wares cannot be sold by telephone, while his competitor across the street may credit half his business to the telephone. Each day brings word of some new triumph of telephone salesmanship.

A New Jersey dealer in automobile tires and accessories keeps a lookout on the busy street in front of his store for passing machines. When he sees any with worn tires or any lacking some of the equipment he carries, he notes the license number on the car, telephones the state department of motor vehicles for the owner's name and then canvasses the prospect by telephone.

A Fifth Avenue jeweler sells clocks by telephone, setting off the chimes with the telephone held alongside.

Still another use to which the telephone recently has been put is in securing members to organizations. This innovation, while less spectacular than the aforementioned, serves to open up a big and profitable field for telephone usefulness. Every fall the Brooklyn Institute of Arts and Sciences conducts a systematic telephone campaign, seeking new members and subscribers among their prospects listed in the telephone directory.

Recently, the Advertising Club of New York conducted a lively membership contest to bring its roster up to the limit set by its constitution. The busy advertising men found it difficult to get out among their confères and boost the new organization. One day a member bethought himself of his telephone, turned to it and before he had hung up the receiver, secured five new members.

He reported his experience to the chairman of the membership committee, who at once issued a bulletin to the entire membership, suggesting that the telephone be enlisted in the campaign. The contestants were quick to take the tip and soon the applications began coming in in such large numbers that a hurried meeting of the membership committee was called. The contest was declared closed, the roster full, the dues raised and a waiting list begun.

Fundamental Principles of the Telephone Business

A Reading Course Designed to Present Logically the Principles Which Underlie Successful Organization and Operation of Telephone Properties—Prepared Under the General Supervision of Stanley R. Edwards—Part I, Telephone Economics, by James H. Shoemaker, Completed June 26, 1915—Part II, The Corporate Telephone Organization, by J. C. Kelsey and S. R. Edwards, Completed September 25, 1915—Part III, Telephone Accounting and Auditing, by James H. Shoemaker, Completed January 15, 1916—Part IV, Telephone Finance, by J. C. Kelsey and S. R. Edwards, Completed June 3, 1916—Installments Now Being Presented Comprise Part V, Telephone Advertising and Publicity, Written by Roy D. Mock

Quiz Questions on the Preceding Installment.

22. How can the effect of an advertisement be spoiled through poor make-up?

23. Why is balance in an advertisement of importance?

24. Illustrate various kinds of balance.

CHAPTER III. Layouts of Advertisements (Cont'd).

25. *Illustrations and Their Use in Advertising.*—One more matter comes up in respect to layouts and that is in regard to illustrations. The purpose of any advertising illustration is two-fold: First, to attract attention and second, to illustrate something which is important for the reader to know.

Undoubtedly there is great power and interest in a picture.

IF YOU KNEW
WHAT WE KNOW
About Tri-State telephone service, you wouldn't be without it at twice the cost.
With the new equipment, now being installed in Minneapolis, calls will be made in seconds rather than in minutes—errors will be the exception, rather than the rule—no waiting—no wrong numbers—you dial any number in four seconds—you disconnect in one—no increase in rates. Residence service $2.00 and $2.50; Business $4.00. Order Now.
CALL CONTRACT DEPT., CENTER 8.
TRI-STATE TELEPHONE CO.
"Th' thing thet I like most 'bout the Autymatick," affirmed Mrs. Jonathan Hep as she practiced the new dance step, "is thet stid o' tryin' to make machines oaten human beings; they've made some'n more than human outen a machine."
INDEPENDENT
LOCAL AND LONG DISTANCE TELEPHONE

Fig. 17. A Good Illustration of White Space and Balance.

A picture appeals to all ages, races, and classes of individuals. Illustration is a universal language. Because of this fact, pictures always have been used in advertising and undoubtedly always will be. But unless the illustration links up carefully with the reading matter of the advertisement, it had better be left out.

A big picture of a frog or toad at the top of a telephone advertisement will attract attention, but it will not help sell telephone service. In fact, it may actually hinder the sale of telephone service because to most people a frog or a toad is not a pleasing object. In this case, the advertisement will be of the type which everybody will see but nobody will read. An illustration of a woman using an extension telephone at the head of the stairs will furnish equal interest, be more pleasing and will say something definite about telephone service. Perhaps an advertisement of this kind will not be seen by so many people, but it will be read by more, and more business will result.

There appears to be a tendency on the part of advertising men to use fewer pictures and to pay more attention to type display. This is a recognition of the fact that people are really practical—that the day of picture writing is past, and that people, who are intelligent enough to subscribe for newspapers and magazines, can be appealed to on grounds of logic and common sense. The past few years have seen a great decrease in the number of advertising illustrations used simply to attract attention, and a proportionate increase in the use of illustrations designed to instruct and to tell something about the article or service which is being advertised.

One illustration, which should certainly be used in every telephone advertisement, is the Shield of Independent telephony. The wide-spread publicity which has been given this shield makes its use a desirable asset in telephone advertising. This will be more fully discussed later in the series.

26. *Illustrations of White Space, Balance and Use of Borders.*—Figs. 17, 18 and 19, reproductions of advertisements run by the Tri-State Telephone & Telegraph Co. in the St. Paul papers, are unusually good illustrations of the proper use of white space, and also effective balance. Note in Fig. 17 how the cut of the telephone instrument at the top balances the Independent Shield at the bottom; also in Fig. 19 how the two masses of display matter in Caslon Italics balance each other. Observe the clever use of printers' rules in Figs. 17 and 19. These advertisements show the possibilities of ordinary rules in holding an advertisement together and giving it an unusually attractive appearance. This kind of display is available with any newspaper or in any printing office, as the rules are standard and every printer should have them.

Ordinarily it is not advisable to use lines to separate the various type portions of an advertisement. The one shown in Fig. 19 would undoubtedly have been improved a trifle if the line just above the words, "Call Contract Department," had been left out.

In Fig. 18 observe how the white space and the careful balance of the advertisement make the proper portions stand out. Including the italics, only three faces of type are used in this advertisement. The italics are Old Style Italics and harmonize well with the type used in the body of the advertisement.

'What a Relief!'
That's what one woman said the first time she used her new Automatic telephone.
"In comparison with manual service," she continued, "It is superior in every way.
"I've been so in the habit of wondering whether Central was mistaken or not, when she reported 'line busy,' or 'they don't answer!' "
It is a wonderful relief to know that the Automatic really means "busy" when the buzz-buzz comes on the line.
Try the Automatic in your home.
Tri-State Telephone Co.

Fig. 18. White Space and Careful Balance Gives Emphasis.

The advertisements reproduced in Figs. 20 and 21 are submitted as examples showing careful balance and good typography, with the exception of the borders which are much too heavy. In the newspapers these advertisements had about one inch of white space around them. An advertisement of this kind will undoubtedly be seen in the paper, but the extreme weight of the border has a tendency to attract the eye to the border itself rather than to the sub-

Is Your Home Phone-Protected?
¶ The question is no longer "Can I afford a telephone?" but, "Can I afford to be without one?"
¶ For the protection of home and the loved ones therein, in cases of emergency.
¶ For convenience in reaching your friends and business associates.
¶ These things alone make a telephone an actual home necessity, and considering that a telephone in the home can be had for $2.00 per month.
Can You Afford to be Without One?
CALL CONTRACT DEPARTMENT
LOCAL AND LONG DISTANCE TELEPHONE

Fig. 19. Balance and Borders.

IN making the famous Ryan Hotel both absolutely modern and the service it offers ultra-efficient, a
Tri-State Telephone
has been installed in every room.

Fig. 20. Border Too Heavy.

Figures the Same In All Languages
With the Automatic Telephone you never have trouble making an operator understand the number wanted.
Figures are the same in all languages. It is only necessary to pick them out on the dial, one by one, to establish any desired connection.
OBVIOUSLY—the Automatic telephone plays no favorites.
Tri-State Telephone Co.
"Th' old fashuned phone is a hull lot like a woman," observed Mrs. Jonathan Hop as she hung out a few clothes, "it's gotta tell all yer secruts to another woman to git her to help it keep 'em."

Fig. 21. Heavy Border Has Tendency to Hold Eye's Attention.

ject matter. Notice how difficult it is to make the eye rest on the type matter. The tendency is to look at the border—to follow the intricate designs it displays—rather than to read the advertisement itself. Contrast Fig. 22 with Fig. 21. It is the same advertisement with the border removed. Observe how the elimination of the heavy border makes the heading stand out.

Owing to the size of TELEPHONY'S pages and the limited amount of space available, it is, of course, impossible to present full size reproductions of the advertisements discussed or commented upon. The comments relative to the telephone

Figures the Same In All Languages
With the Automatic Telephone you never have trouble making an operator understand the number wanted.
Figures are the same in all languages. It is only necessary to pick them out on the dial, one by one, to establish any desired connection.
OBVIOUSLY—the Automatic telephone plays no favorites.
Tri-State Telephone Co.
"Th' old fashuned phone is a hull lot like a woman," observed Mrs. Jonathan Hep as she hung out a few clothes, "it's gotta tell all yer secruts to another woman to git her to help it keep 'em."

Fig. 22. Advertisement of Fig. 21 Without Heavy Border.

advertisements reproduced in connection with this series of articles on "Telephone Advertising and Publicity," are presented not with the idea of fault-finding but with the spirit of constructive criticism. In other words, the criticisms are intended to be productive of good through illustrating some particular features which make for a better advertisement, or detract from the effectiveness of the presentation.

(To be Continued.)

Wire Chiefs' Conference at Seward, Neb.

The second of a monthly series of wire chiefs' conferences was held by the Lincoln Telephone & Telegraph Co., at Seward, Neb., on June 23. A great many matters of interest in maintaining telephone service were discussed.

Preceding the meeting, an inspection committee, composed of K. B. Kary, of Lincoln; F. M. Strasser, of David City, and D. C. Wilson, of College View, spent Wednesday and Thursday, June 21 and 22, in making a careful inspection of a part of the Seward exchange. They prepared a detailed report of the plant inspected, showing the switchboard and entire equipment to be in excellent condition. The report contained 173 items regarding condition of poles, wires, cables and telephones, both in the city and surrounding country, and for the most part the report was complimentary to Mr. Dupin, Mr. Sanborn and the local force of employes, and showed that they are doing good work in maintaining the telephone exchange.

Very few conditions were found which deserved criticism, but it was meted out where deserved. In addition to observing the plant from a standpoint of good service the committee looked carefully for places where the public or the company's employes might be endangered, due to improper construction, or exposure to electric light lines. A few places were found where the electric light and telephone lines in Seward were too close together and these will be taken up with the city light commissioner, with a view to clearing them up by co-operation between the city and telephone company.

An interesting paper on "How to Prepare and Get Reports in On Time," was read by Manager Nickols, of University Place.

Those present at the meeting were: Plant Superintendent M. T. Caster, Lincoln; District Plant Chief F. E. Behm, Lincoln; Chief of Service T. S. Risser, Lincoln; District Inspector R. S. Brewster, Lincoln; Toll Wire Chief C. S. Blodgett, Lincoln; Manager Mapel, Utica; Manager Noyes, Tamora; Manager Schulling, Greenwood; Wire Chief Sanborn, Seward; Wire Chief Strasser, David City; Manager Wilson, College View; Manager Nesladek, Waverly, Manager Dupin, Seward; Wire Chief Kelly, Ashland; Manager Overcash, Beaver Crossing; Manager Gilchrist, Cedar Bluffs; Manager Nickols, University Place; Manager Manners, Wahoo, and Wire Chief Downing, Milford.

Both the meetings at Seward and Superior were very successful and it is believed that much good will be accomplished by these meetings in improving the service and plant conditions of the various exchanges in the Lincoln company's system and in stimulating the local managers and wire chiefs to greater efforts.

Microphone Aids German Submarine in Crossing Atlantic.

The story of the remarkable voyage of the German submarine, Deutschland, across the Atlantic, arriving at Baltimore, Md., on Sunday, July 9, was recently told in the newspapers by Captain Paul Koenig. Upon being questioned as to his best aids to navigation, and as to how he figured out his safe progress under sea, he replied as follows:

"The microphone and our device for taking soundings while submerged did the trick. Everybody understands these days what the microphone is—an under-sea telephone, so delicate that it catches and records the vibrations of any bulk moving upon or under the waves.

We have two microphones on the Deutschland, one on the port, one on the starboard side. One of us, an officer if possible, kept an ear always to the receiver. When we heard disturbing murmurs through our little eavesdropper we stopped dead still, maybe, or went ahead slowly. Sometimes we dropped to the sea floor and kept as still as a mouse until we could figure out what the menace was. Sometimes we merely dropped 50 feet or so beneath the surface and anchored in that position, suspended between the surface and the bottom. The microphones warned us of cruisers and destroyers and sometimes of buoyed mines.

With the microphones we were able to hear the whistling of a buoy six miles off when we were under water. And just before we came up about 30 miles from the Virginia capes we were able to hear the ringing of a bell buoy six miles from us."

Practical Subjects—Letters and Discussions

INDEX FOR TELEPHONY, VOLUME 70.

The index for Volume 70 of TELEPHONY, which was completed with the issue of June 24, 1916, is now ready for distribution among those who keep complete files of TELEPHONY. In this index are listed the most important articles which have appeared in TELEPHONY between January 1 and June 24, 1916. It will be supplied free to those making application.

"Telephony's" Home Course for Telephone Men.

(Not meant for study.)

By Well Clay.

MISSIN' TH' BIG PARADE.

My name's Bill.
I went an' busted my leg
A shinnin' up a tree.
They toted me home
'N made me smell of a rag;
Which was th' last o' me
'Til th' doctor he got through
A fixin' my leg.
An' that's how
I'm a layin' here
On th' Fourth o' July.
C'n y' beat it?

Jest think! All th' rest o' th' kids
Are adrinkin' lemonade
An a shootin' crackers
An' a havin' cords o' fun;
All exceptin' me—I'm here.
I got ter miss th' big parade.

My ma, she's here too;
Couldn't bear t' go an' leave me alone—
So she said—
Ma, she's funny. I'd a gone,
Y' bet y'r life,
'Cause th' Fourth only comes
Jest once a year—like Christmas;
A feller's jest bound t' hump hisself
So 's he won't miss what's a goin' on.

Our ol' dog; he's home, too,
'Cause y' see he's afraid
Of them there fire crackers
And sich like,
'Cause they tied one t' his tail once,
So he don't care f'r th' big parade.

My bed's sot by th' winder
Where I c'n see out on th' lawn—
Don't have t' mow that now anyhow—
'N I c'n hear them yellin'
Down on Main street.
'Spose it's when they finishes a race,
'Cause they're goin' t' have all kinds—
Sack, 'n potato; 'n spoon; 'n all kinds.
Wish I was there,
But I ain't.

I c'n see 'n old Robin Red Breast
A hoppin' 'crost th' grass;
Head all cocked t' one side
Like he was a listenin'.
Pretty soon he makes a dip
'N grabs a big long angleworm;
Keeps a pullin' 'til Mr. Worm lets go;
Then Mr. Worm, he takes a walk down Mr. Robin's neck.
So y' see I ain't th' only one
What's goin' t' miss th' big parade.

No, ma'am, the above is not intended to represent poetry, nor even a mild form of verse. It does not even ryhme—still, in a way, it reads all right if one accents it at the right places. However, let it go at that. It tells a story and, after all, that is the primary intent of any form of literature.

I wonder how many of us larger boys are missin' some of the big parade. How many of us have "shinned" up some financial tree and busted a leg which has laid us on our backs, so to speak, and held us down while the more fortunate ones have paraded by us on the road to success?

We hear the sounds of their revels, as it were, down on Main street, and are precluded from being among them by reason of our financial hurt. We hear the horns of their autos as they sail by leaving us in a cloud of dust which affects our eyes and makes us resentful, notwithstanding the fact that we would change places with them any old time were there the ghost of a show.

Our families, like the mother in the foregoing tale, are detained along with us and we seemed destined to miss all the fun there is for a long time ahead. It does seem, too, that while we are detained from being in the crowd, there are more interesting things and events happening than ever before. Perhaps our incarceration is occasioned by our sloth in getting and keeping up to date in our business. Perhaps we do not see clearly enough the connection between industry, perseverance, and sacrifice on the one hand and success on the other.

We may say of the fellow who toils early and late to master his profession, that he is merely working himself to death to no purpose. He is probably overdoing it, in some instances, but in the majority of cases a person is not hurt if he works hard for a few years, so long as he is interested in the work and follows the right lines of endeavor.

However, you are right! This has nothing to do with the telephone business, being merely theoretical as it were. Some day I am going to build a theoretical line. I shall put all the cross arms on an angle of 45 degrees with the high end on the field side of the pole so that when I ride along in an auto looking for "shorts," I will have no trouble in seeing one easily, should I come across it, without the bother of stopping the car and dislocating my neck in making sure of the fact. You boys who ride the lines, can pretty nearly always tell when there is an actual "short" by the way the line looks. It's when there really isn't a "short," but only looks like one, that fools us.

Theoretically, then, this would be the way to overcome the difficulty and add to the efficiency of the lineman. It would not shed water any better because it was on a slant, 'tis true, but, aside from looks, it would be a very handy line to patrol.

Then, too, I would make a lightning arrester for the instruments which would have a lever that would throw the connection off the carbon on one side. That side I would mark "winter position." The side which threw the carbon and mica back into working order, I would label "summer position." Then the patron could throw the switch in the fall and the line would be clear of all that resistance during the winter. In the summer the manager could have the line cleared by telling the subscriber to work the switch back and forth a few times so that the carbon hemisphere would pass over a seam of felt running across the diameter of the arrester, which would clean it of all "smut." Then, after doing this, have him leave it on the summer side. This, theoretically, would be a great improvement and save a lot of livery.

I will, of course, have a tally box built into the telephone so that I can tell the number of times the receiver is taken off the hook. The figures might come handy when the patron begins one of them hoary yarns about "never going near it more than once or twice a month." Of course, I will place all the wires where the farmer is never going to plant trees. I suppose then I will have to kill the farmer so he won't change his mind. I don't know of any other way to make it work.

I will make the instruments with a detachable backboard to which will be attached two metal strips nearly meeting at top and bottom. Then when I install an instrument, I can

place the backboard where it should go. It will be light and easily handled by one man and the wires from the lines can be brought in through the back and connected to the terminals without knocking any skin off his kuckles.

The balance of the instrument can be hooked over the terminal connections and fastened with a screw at the bottom. This will be handy when the telephone gets out of order, for then, instead of going out to fix it up, the manager can have the patron detach the front from the wall and bring it in for repairs, as all the wiring except the two terminals will be in the front part. The manager can even have the patron bring it in to have new batteries installed, if necessary—usually the patron, who comes to town often, does not mind a little extra work so long as he can get his telephone working right off.

The patron will not go to the trouble of taking off the whole front in order to look inside every other day, so that will cut out a lot of rural "inspecting."

I will have several screw holes in the backboard so that when the first two screws go into solid wood and the other two into plaster between the laths, I will not have to take out the first screws and move to another position up or down in order to strike better holdings. I will merely put the screws into the extra holes until they "take hold" and thus save defacing the wall.

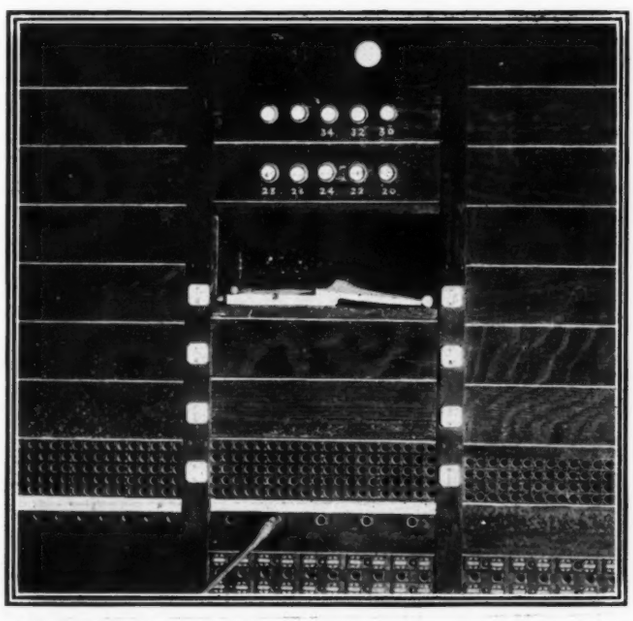
I don't know when I will get time to do all this, but it sure will be a handy line—if it works. In the meantime I have to keeping going on stuff built along the old lines, so as to keep from getting too far behind with orders and thus miss a part of the big parade.

APHORISM: If theories worked, we wouldn't.

Gauging Water by Telephone.

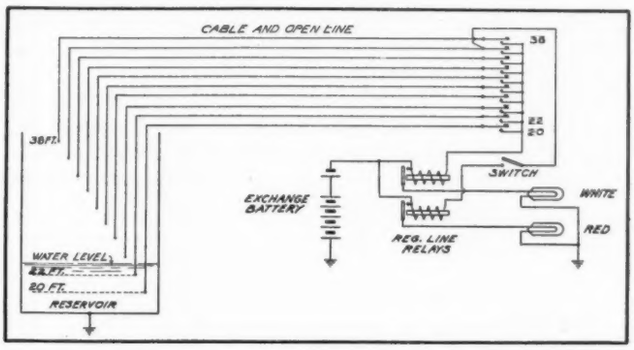
By Henry C. Larrabee.

The system described was installed by the writer about six years ago and has worked during this time to the entire satisfaction of the telephone company and the water company. It has saved the water company a great deal of trouble and expense as it was formerly necessary to send a man to the reservoir twice every day to note the conditions, height of the water, etc. The telephone company receives a nice revenue for the service and is put to very little extra work or expense; in fact, the first cost of the installation is about all that there is to it. This need not be over a dollar for the office equipment, while the outside construction expense will depend entirely upon the proximity of the lead to the reservoir.



Face of Switchboard Showing Push Buttons and Signal Lamps.

A glance at the diagram will show the simplicity of the circuit and apparatus used. The equipment at the reservoir consists of a plank about 10 inches wide and 18 feet long fastened to the side of the reservoir in a vertical position. The conductors, of No. 10 bare copper wire, are stapled to the plank, terminating two feet apart, from the bottom up. The wires can be placed quite close to each other provided a sufficient number of staples are used so there will be no danger of a cross. The plank will last much longer if painted or treated with a preservative of some kind. A short pole near the edge of the reservoir serves to support the duplex drop wire, which is connected from the nearest cable or open wire lead.



Circuit for Ascertaining Height of Water in Reservoir.

At the exchange the only material that had to be purchased was the "Midget" push buttons as shown in the illustration. The lamps are the regular line and supervisory pilot lamps. The regular exchange battery is used as are also the two line relays. These were spare lines and none of the switchboard wiring was altered in any way in wiring up the circuits. It was only necessary to remove the line lamps and attach a wire to each lamp jack so as to extend the circuit to the reservoir lamps, the other side of the reservoir lamps being connected to ground.

Wires were then soldered to the sleeves of the answering jacks, corresponding with the line relays used, and run to the Midget buttons. One wire is common to all of the buttons and the other, having a switch in circuit, is attached to the reservoir side of any button as required by the water company to indicate when the reservoir is as full as desired. In the system, as installed, the red lamp was lighted at 36 feet.

The illustration shows the arrangement of the buttons and signal lamps on the front of the switchboard. The operation of the equipment is as follows: The attendant at the pumping station, wishing to know the amount of water in the reservoir, calls the operator over the regular telephone line. She presses the buttons, beginning with the lowest number of feet and reports to him the highest button which will light the white lamp. In this way the attendant knows when to start pumping water into the reservoir and when to stop.

As soon as the reservoir is full, the red lamp will be lighted automatically and the telephone operator calls the pumping station, reporting "Red light on, time, 4:30 p. m." She then opens a switch which extinguishes the lamp.

It will be seen from the circuit diagram that no current is used unless the operator is reporting to the water company or during the short time that the red lamp may be on before the switch is opened. It is, of course, necessary to close this switch some time later, after the water has gone down.

It has never been necessary to change the adjustment of the line relays which operate the signals, neither was there any trouble from heavy rains wetting the plank and causing false readings. During a heavy wind, however, the waves beating against the plank will cause a "flashing" reading to be made, one button higher than normal. But this is easily detected and proper allowance can be made.

Economical Methods of Preserving and Indexing Records.

By F. J. Sheldon.

The Interstate Commerce Commission, in the exercise of its authority to regulate the activities of telephone and telegraph companies, has prescribed the length of time that all records or memoranda pertaining to the accounts or administration of a company must be retained. Many of these records or memoranda (chiefly those supporting charges to fixed capital) must be retained permanently. The huge volume of such items as workmen reports, work orders, bills, time sheets, material records, etc., even in a company of small proportions, has confronted the officers with the difficult problem of preserving these records in such shape as to be readily accessible when the occasion demands and without entailing an expense out of proportion to the value of the records themselves.

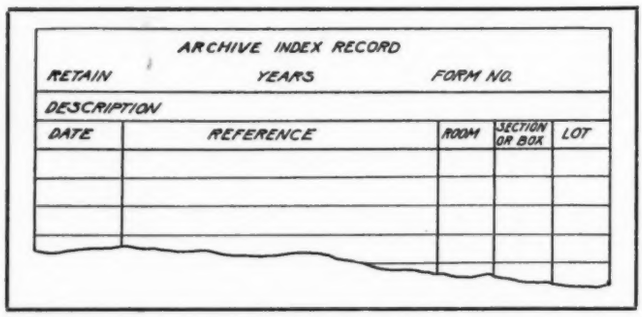


Fig. 1. Form for Index Record Card.

The suggestions that follow were gleaned from the writer's personal observation of the methods employed in several of the largest telephone companies of the Middle West. Many of these companies are devoting considerable attention to this subject and all of them have already been called upon to furnish information to the commission that necessitated referring to detail records several years old. Those companies which gave little or no attention to systematic methods of retaining their records awoke to the realization that the extra cost of obtaining informaion from records so kept was far in excess of the cost of installing an adequate filing system.

Records that are current and referred to with any degree of frequency, are kept to best advantage in vertical filing cabinets which are on the market in an infinite variety of styles, sizes and prices. As indicated by the title, this article is intended to suggest methods of preserving records of a more or less permanent nature and therefore the subject of current files is not discussed further.

A method which combines utility with economy and for which the only equipment required is a supply of heavy fiber boards cut to the size of the document and some stout cord is used with success for preserving reports of workmen, time sheets, requisitions on storerooms, work orders and like documents which are not conveniently adapted to the bound book method of filing. The excessive cost of transfer cases for voluminous items such as these is easily appreciated. The documents to be preserved are tied in packages of uniform size between two of the heavy fiber boards and the packages are numbered consecutively beginning with number one. They are then placed on the shelves of the file room with the oldest documents in the most remote section.

Various methods of bundling the documents will suggest themselves. Some documents may require the protection of wrapping paper but experience has proven that the heavy fiber boards afford ample protection for all ordinary records of this class. The fiber board recommended is a heavy but inexpensive variety commercially known as "Seaboard."

A binding strap that works on the principle of a non-elastic garter is an improvement over cord for binding the package. When this device is used a single document can be removed without undoing the entire package. In fact, the ease of reference with this scheme is superior to transfer cases. These straps are manufactured by the National Binding Strap Co., of Pittsburgh, Pa., and are furnished in any length at a reasonable cost.

The advantage of an index for permanent or semi-permanent records is emphasized each time that it is necessary to refer to these records. The method of filing just described readily adapts itself to a simple yet efficient index scheme.

The shelves in the file room are divided into sections (imaginary if not real) and each section numbered. The packages which are also numbered are placed on shelves in consecutive order. For the index itself, cards are superior to a book. The card is headed with the name of the record and the form number with the index information tabulated as shown in Fig. 1.

As the files increase it will become necessary to remove the oldest records from the shelves to make room for records transferred from the current files. The records removed are not likely to be referred to again but it is required nevertheless that they be retained permanently or nearly so. The packages removed from the shelves can be packed in an ordinary packing case or dry goods box. The packing cases are numbered consecutively and the index card is corrected to show the packing case number instead of the shelve number. The files can then be moved from one location to another without the confusion usually attendant upon such an occasion.

If it is necessary to know the exact position of a document in the packing case a diagram of the contents will fill this requirement. For instance, suppose the packing case contained 27 packages in three layers of nine packages each. A diagram is made for each layer as shown in Fig. 2. With the aid of the index and the diagram it is possible to go directly to the desired package without disturbing the other 26 packages.

It is impossible to lay down hard and fast rules on this subject as no two companies, even when engaged in the same business, will follow exactly the same methods of accounting for their various activities. Indeed uniformity is not always obtained in all of the branches of one company. The foregoing suggestions are, therefore, more or less general in nature and should be modified to suit each individual requirement. The economy of these or similar schemes is well worth the effort when it is considered that the capital which would otherwise be invested in expensive transfer files can be diverted into more profitable channels.

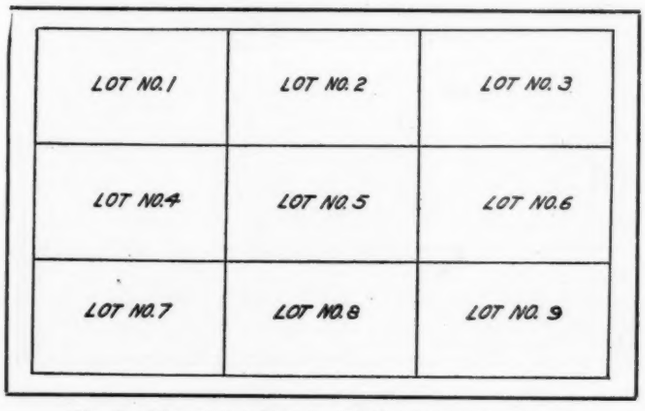


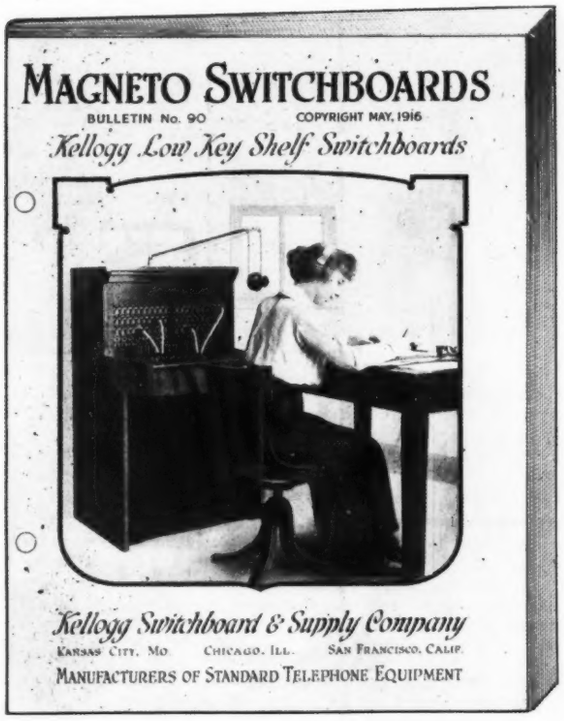
Fig. 2. Diagram to Show Contents of Packing Case.

From Factory and Salesroom

Conventions: Indiana Independent Telephone Association, Indianapolis, September 14-15; United States Independent Telephone Association, Chicago, December 6-8

New Kellogg Bulletin on Magneto Switchboard.

A new 40-page bulletin on magneto switchboards has just been issued by the Kellogg Switchboard & Supply Co., of Chicago. This bulletin covers the new low keyshelf boards and is of interest to every telephone man who is either


MAGNETO SWITCHBOARDS
BULLETIN No. 90
COPYRIGHT MAY, 1916
Kellogg Low Key Shelf Switchboards
Kellogg Switchboard & Supply Company
KANSAS CITY, MO. CHICAGO, ILL. SAN FRANCISCO, CALIF.
MANUFACTURERS OF STANDARD TELEPHONE EQUIPMENT

Reproduction of Cover of New Kellogg Bulletin.

contemplating new central office equipment, or merely interested in the development of better switchboard apparatus.

The bulletin is handsomely illustrated with half tones of cabinets and apparatus. The diagrammatic cabinet drawings, face and rear equipment sketches and circuits, make it easy for the prospective purchaser to plan intelligently for new central office equipment. The clear and comprehensive descriptions assist in making these drawings more valuable.

The Kellogg company invites every telephone man who is interested, to write for its bulletin No. 90.

New Board at Maysville, Ky., Shows Excellent Results.

One month to a day after the new Stromberg-Carlson central energy board was put in service at Maysville, Ky., by the Maysville Telephone Co., Warren M. Paine, assistant superintendent of the Central Home Telephone & Telegraph Co., made a service test which showed excellent results. Twelve first calls consumed a total of 25 seconds, an average of 2.1 seconds, and the same number of second calls a total of 30 seconds, an average of 2.5 seconds.

Engineer of Construction Meinema, who represented the Stromberg-Carlson Telephone Mfg. Co. in the installation, was exceedingly complimentary as to the way the operators took hold of the new board, saying that he had seldom seen anything like it. For the first month Miss Jessie Wilmot, chief operator at Frankfort, was on the ground training the Maysville operators in the operation of the new system.

Transfer of Garford Business to Stromberg-Carlson.

As announced in the advertising section of last week's issue of TELEPHONY, the Stromberg-Carlson Telephone Mfg. Co., of Rochester, N. Y., has purchased the entire telephone business of the Garford Mfg. Co., of Elyria, Ohio. The sales, engineering, switchboard and installation departments have already been moved to Rochester and the manufacturing equipment and tools will be transferred from Elyria to Rochester by the end of this month. All correspondence should now be addressed to the Stromberg-Carlson company at Rochester, or at any of its branch offices, the Garford telephone business being handled entirely from now on by the Stromberg organization.

New Switchboard for Laurelville, Ohio.

Included in the improvements now being made by the Citizens Telephone Co., of Circleville, Ohio, is the installation of a new switchboard in its Laurelville central office. The new board, which is shown in the accompanying illustration, consists of two of the Stromberg-Carlson Telephone Mfg. Co.'s No. A-11,664 low keyshelf type single position sections bolted together as one continuous cabinet. Each section is wired for an ultimate capacity of 70 lines and equipped for present operation with 40 500-ohm plug-restoring drops.

If required the line capacity can be increased to 100 lines

Stromberg-Carlson Magneto Board for Laurelville, Ohio.

per section by removing the ticket boxes and voltmeter panel now installed in the two end panels. The voltmeter panel is wired in connection with two plugs and cords so that tests can be made for men working on the lines by the operator at the second position.

Each section has an ultimate capacity for 15 pairs of connecting cords. The first position is now equipped for 10, and the second position for five pairs of cords arranged for four and eight-party harmonic ringing with individual keys.

Information regarding either this or similar types of switchboards can be obtained by addressing the nearest office of the Stromberg-Carlson Telephone Mfg. Co., and such requests will receive prompt attention.

Paragraphs.

THE COFFEY SYSTEM & AUDIT CO., of Indianapolis, Ind., is making the regular quarterly audit for the Logansport Home Telephone Co., of Logansport, Ind., this week.

Condensed News Reports

Officers of Companies Are Urgently Requested to Forward to Us Promptly All Financial and Other Statements as Soon as Issued and Any Items of Interest as to Their Plants and Systems

New Companies and Incorporations.

KILBOURNE, ILL.—The Kilbourne Telephone Co. was incorporated recently with a capital stock of $1,000. The incorporators are John Boyle, Harry Howe and Mrs. Minnie Howe.

DUNCAN, IOWA.—The Duncan Telephone Co. has been incorporated with a capital of $6,000. J. J. Frick, Frank Trica and Fred Reihm are the incorporators.

MORNING SUN, IOWA.—The Mutual Telephone Co. has been incorporated with $25,000 capital stock. The directors are C. B. Willson, J. J. Caldwell, H. E. Cummings, W. H. Van Horn, F. M. Brown, S. G. Robertson and I. M. Jamison.

BOWLING GREEN, KY.—The Rockland Telephone Co. has been incorporated with $1,000 capital, by T. R. Hines, J. S. Justice and A. J. Stahl.

GLASGOW, KY.—Basil Richardson, W. L. Porter and R. H. Porter have organized a new telephone company to be known as the Glasgow Telephone Co., with capital stock of $100,000, with a view of acquiring properties of the Gainesboro and Home telephone companies. These two companies together operate 600 telephones in Glasgow county and 1,560 in Barren county.

ALVARADO, MINN.—The Alvarado Telephone Co. has been incorporated with a capital of $50,000. James W. Lundgren, Ole M. Smith, O. N. Peterson, Peter Norland and Iver N. Lodoen are among the incorporators.

WINONA, MINN.—The Suburban Telephone Co. was incorporated recently with a capital stock of $5,000.

ACTON, MONT.—The Lake Basin Farmers Independent Telephone Co. was incorporated recently. The capital stock is $40,000. The incorporators are J. G. Coakley, C. L. Waring and M. J. McCarthy and Albert Sump.

CARLYLE, MONT.—The Beaver Valley Telephone Co. has been incorporated with a capital of $10,000. I. A. Morris, F. M. Hopper and L. Preiner are the incorporators.

HELENA, MONT.—The Lake Basin Farmers' Telephone Co. filed articles of incorporation recently. The capital is $40,000. The incorporators are J. G. Coakly, C. L. Waring, W. J. McCarthy, E. E. Sidebottom.

BISMARCK, N. D.—The Naughton Telephone Co. has been organized to operate lines northeast of here in the vicinity of Naughton township. The following will be the officers: C. A. Carlson, president; C. A. Johnson, vice-president; A. Johnson, secretary, and August Solberg, treasurer.

UPHAM, N. D.—The Upham Rural Telephone Co. has been organized by J. E. Westford, L. L. Moen and W. E. Ebersole.

ROSA, N. M.—Incorporation papers were filed recently by the Rosa Ignacio Telephone Co., of Rosa, San Juan county. Alfred H. Long was named statutory agent. The capitalization is $10,000. The company will operate a telephone line from Ignacio, Colo., to Rosa.

PRINCETON, PA.—The Princeton Telephone Co., with a capital of $5,005, was incorporated recently. The incorporators are Edwin T. Sechler, John W. Sheaffer, George Dean, William Weigle, Silas Young, N. C. Dick, Milton Hogue, Frank B. Houck and John Munnell, Princeton.

BLUNT, S. D.—The Bretton Telephone Co. has been incorporated with a capital stock of $1,000. H. E. Carey, J. C. Higgins, D. D. Foot and William Greenfield are the incorporators.

TIMBER LAKE, S. D.—The Little Oak Telephone Co. was incorporated recently with a capital stock of $10,000. The incorporators are Simon A. Schere, Peter Jacobson, M. H. Burke and Guy Long, all of Timber Lake, S. D.

CHINA SPRINGS, TEX.—The China Springs Telephone Co., with a capital stock of $2,232, was incorporated recently. The incorporators are T. N. Curtain, D. G. Stewart and Frank Walker.

GRANTSBURG, WIS.—The Marshland Telephone Co. has been incorporated with a capital of $1,200. D. S. Dengrey, A. Hanson and I. K. Barrett are the incorporators.

Franchises.

BRYAN, TEX.—At a meeting of the city council the Bryan Telephone Co. was granted a franchise to do business for the next 20 years. The company agreed to furnish 10 telephones to the city free of charge for the first 10 years of the grant and 15 telephones free of charge after that time.

Elections.

BLACKDUCK, MINN.—At the meeting of the stockholders of the Blackduck Farmers' Telephone Co., John Thullen was re-elected president, and E. L. Oberg secretary-treasurer, for the year 1916-17. The other members of the board of directors are: Charles Gunderson, Inez, vice-president; Herman Thom, Hornet, second vice-president; Otto O. Myran, Inez, third vice-president.

HOWARD, S. D.—The annual stockholders' meeting of the Hansen Telephone Co. was held recently and the secretary's report for the first four months of 1916 showed a large profit. It was decided, however, to add the profits to the reserve for the improvement and deevlopment of the line. The officers were all re-elected.

Financial.

DES MOINES, IOWA.—The capital stock of the Iowa Telephone Co. has been increased from $10,000 to $15,000.

CURTIS, NEB.—The state railway commission has authorized the Curtis Telephone Co. to issue $1,200 additional stock for the purpose of completing an exchange here.

Construction.

ELYSIAN, MINN.—The Cannon Valley Telephone Co. will remodel its buildings.

NEW HAMPTON, IOWA.—The Hurmence Telephone Co. has awarded the contract for the erection of a $10,000 building.

LIBBY, MINN.—The Pioneer Co-operative Telephone Co. is building a line from Libby to McGregor.

VIRGINIA, MINN.—The Virginia-Cook Telephone Co. will build a line to Sand Lake.

CLEARWATER, NEB.—The North Antelope Telephone Co. is building a new line north of here.

SHELDON, IOWA.—The Farmers & Merchants Telephone Co. has awarded the contract for the erection of a $10,000 building.

KENOSHA, WIS.—The Wisconsin Telephone Co. will improve its plant here at a cost of about $68,000.

QUIMBY, IOWA.—The Farmers Telephone Co. has completed the building of a line from Washta to Quimby.

Miscellaneous.

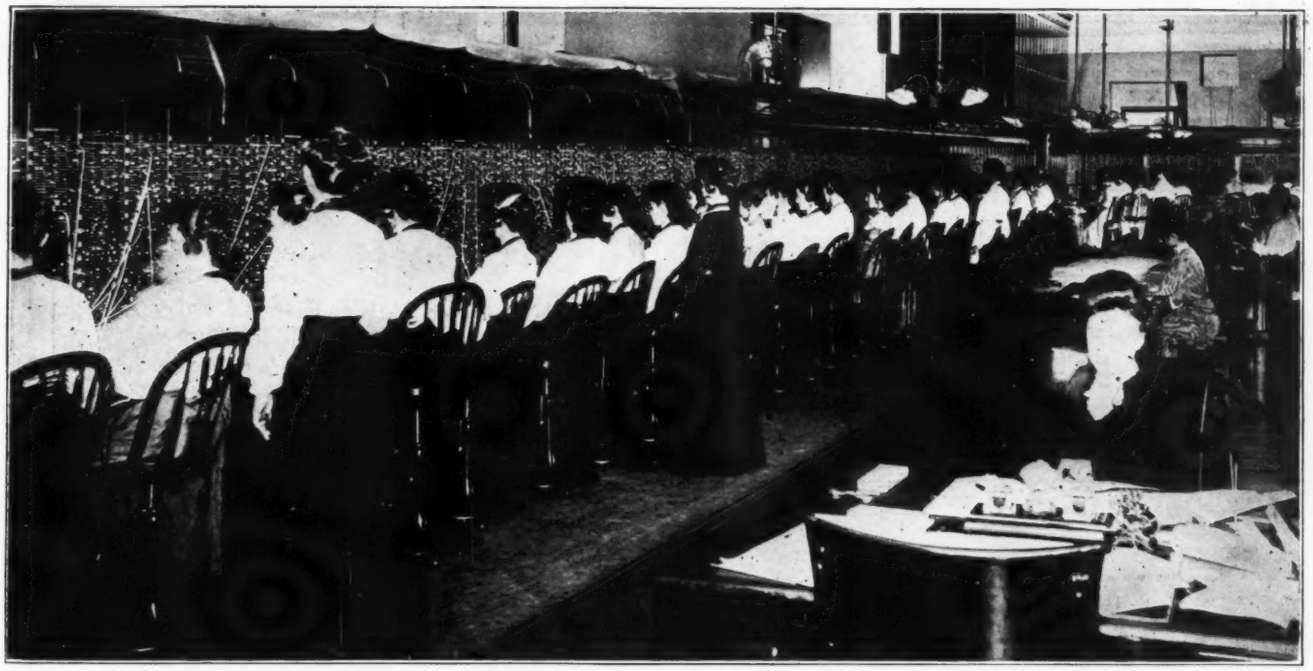
OAKVILLE, IOWA.—The Oakville Mutual Telephone Co. has purchased the property of the Oakville Telephone Co.

STRUBLE, IOWA.—The local office of the Plymouth County Telephone Co. has been discontinued.

SHERIDAN, ORE.—Resolutions of dissolution were filed by the Sheridan Mutual Telephone Co. and the Pioneer Telephone & Telegraph Co. of Prineville, Ore.

DICKINSON, N. D.—The Gaylord Telephone Co. has been granted the right to erect lines along certain highways in the county.

CHANDELLOR, S. D.—Frank Pool has purchased the local telephone exchange.



The Business of the Nation is transacted through switch-boards like these—

The estimated number of telephone messages or talks which are made during a year in the United States, according to the Census Bureau, are over 13,735,658,245.

The excellence of this service depends entirely on the character of connections made.

A good soldering flux plays a "vital" part in promoting good telephone service. Wherever NOKORODE is used the soldering results are *incomparable.* NOKORODE is the old reliable soldering paste which has thoroughly demonstrated its efficiency on some of the most important telephone work. And back of NOKORODE is a positive "money back" guarantee that it will make good.

Non-Corrosive and possesses the additional advantage of economy as its use shows that less NOKORODE is required for soldering purposes than any other soldering paste.

Made in sizes varying from 2 oz. to 50 lb. cans.

1 and 10 lb. cans	$1.00 per lb.
25 and 50 lb. cans	.90 per lb.

Case lots contain 6—1-lb. cans. Discount in case lots, 50 per cent. Discount in less than case lots, 40 per cent.

NOKORODE is also made in form of salts and put up in tin cans.

A 2-ounce can of NOKORODE like this will do many soldering jobs—Sent postpaid on receipt of 20 cents.

Write for a copy of "Soldering Kink News"

The M. W. Dunton Company

150-152 Niagara St., Providence, R. I.

The Home of "Nokorode Soldering Flux"

Please tell the Advertiser you saw his Advertisement in TELEPHONY.

Warner Pole Changers

20 Years in Service; Over 20,000 in Daily Operation

The first successful pole changer made.

It revolutionized "ringing conditions" in the telephone field; and set such a high standard then that it has never been equaled.

Economical and reliable, it has stood the test of long service, and is pronounced the one perfect pole changer by the leading telephone men of the country.

Let us solve your ringing problems.

WARNER ELECTRIC CO., Muncie, Ind.

Which Are You?

There is always a demand for men who are worth more than they are getting—always something better being offered them.

While men who know and do just enough to get by—get no farther—often.

No telephone man can read his TELEPHONY every week and **not** improve his knowledge and ability in his chosen line.

The degree of his improvement depends upon himself—but he will **not** stand still.

If you have not been reading TELEPHONY regularly—commence; if you have not had the opportunity—make it!

Can you spare five cents a week—can you devote this princely sum to the sure betterment of your position and income?

If so, simply write and ask us what the amount will do for you.

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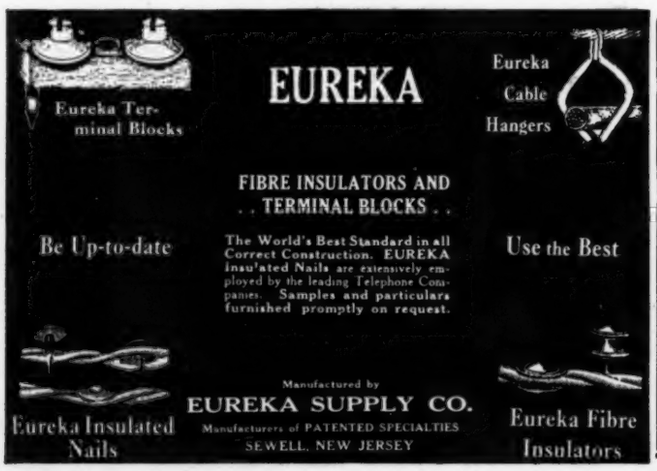
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EUREKA
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FIBRE INSULATORS AND TERMINAL BLOCKS
Be Up-to-date
The World's Best Standard in all Correct Construction. EUREKA insulated Nails are extensively employed by the leading Telephone Companies. Samples and particulars furnished promptly on request.
Use the Best
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SEWELL, NEW JERSEY
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Rebuilt Bargains

KELLOGG golden oak finish, 150-line capacity magneto switchboard, fully equipped with 130 No. 3-A, 10 ohm series, and 20 No. 3-C, 1000 ohm bridging, self-restoring combined line drops and jacks, and the following operator's equipment: 15 pairs of plugs and cords, 15 listening and double ringing keys, 15 single supervision ring off drops, power and hand generator switch key, hand generator, operator's suspended type transmitter, head band receiver and complete night bell equipment, also 15 feet of full capacity line cable from base of board.....$275.00

KELLOGG boards with equipment as above, equipped with 8 order wire keys and 30 flash light transfer circuits 300.00

For complete list of standard apparatus refer to our REBUILT BARGAIN BULLETIN No. 6 (Free on Request). Stock received since Bulletin was published shown in our TELEPHONY ads.

Rebuilt Telephone Equipment Company

2127-2129 West 21st Street Chicago, Ill.